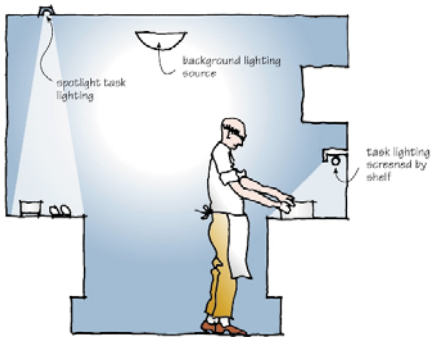
Lighting a Task

Lighting a Task Surface

Lighting task surfaces, such table tops, provide illumination for task activities

- Often **task lighting** refers to office lighting, where the task light is used to increase illuminance on the reading area. However, task lighting is applicable to any task.
- Different strategies for task lighting exist. The three main approaches are:

  - General Lighting (aka Ambient Lighting)
  - Accent task light
  - Fixed Asymmetric task light



Typical Lighting Products

- Table Lamps
- Undercabinet Lighting
- Shelf Lighting

1

Lighting a Task Surface

2

Lighting a Task

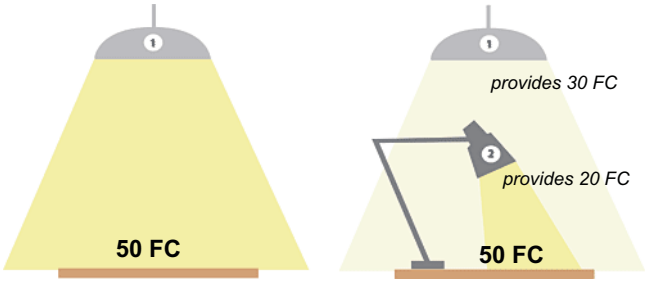
Lighting a Task Surface

Lighting a Task Surface

Task-ambient design approaches save energy when compared with most general lighting strategies - higher light levels are required for the task areas, thus energy is needed for general lighting.

For example, in a task-ambient design, lighting fixtures might be concentrated primarily over work areas, while an indirect lighting system provides relatively low levels of general (ambient) illuminance. Thus, when compared to a more traditional design, which might rely on a uniform layout of direct lighting luminaires, the average light level for the room may be lower, and the number of required light fixtures may be reduced.

General lighting is still the most widely practiced lighting design approach, due to the perception that task ambient lighting equipment is more expensive.



4

Lighting a Task

Target Illuminance / Light Levels

Who Defines Light Levels?

- IES of North America
  - Recommended Practices
  - Defines light levels and quality of illumination by task and application
- Codes and Regulations
- The Owner

Definitions: ***Task*** *= the work performed*

Applications *= the project type (i.e. School, Commercial etc,*

5

IESNA Recommended Light Levels

QUALITY ISSUES FOR OFFICE LIGHTING

	Private Offices	Open-plan Offices	Office Corridor
Control of direct and reflected glare	●	●	○
Light on walls and ceilings	●	●	◐
Physical relation of fixtures to users	●	●	○
Uniformity / Reduce shadows and flicker	◐	◐	○
Room surface characteristics	◐	◐	◐
Color rendering and color temperature	◐	◐	○
Daylighting	◐	◐	○
Lighting controls	◐	◐	○
Quantity of light on task (footcandles)	40-50 fc	40-50 fc	5-10 fc

● Very Important ◐ Important ○ Somewhat Important

* Adapted from the Lighting Design Guide. IESNA Lighting Handbook, 9th Edition

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Lighting a Task

IESNA Recommended Light Levels

QUALITY ISSUES FOR SCHOOL LIGHTING	General Classroom	Computer Classroom	School Corridor
Light on walls and ceilings 1 on photo above	●	●	◐
Control of direct and reflected glare 2	◐	●	○
Uniformity 3	◐	●	○
Daylight 4	●	○	◐
Color rendering and color temperature	◐	●	◐
Lighting controls	●	◐	○
Quantity of light (horizontal footcandles)	40-50 fc	20-40 fc	10 vert. fc

● Very Important ◐ Important ○ Somewhat Important * Adapted from the Lighting Design Guide. IESNA Lighting Handbook, 9th Edition

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Target Illuminance / Ages

Less than 40 years old…

Can reduce the light levels up to 1/3!

Standard Age Range is 40-55 years old

Over 55 years old…

Can increase the light levels up to 2/3!

Babies require 3 times more light than a 20 year old!

8

Lighting a Task

Seeing Light

Illuminance: We do Not See Light Arriving

*Measures how much light there present, the light level to perform a task – **arriving** lighting energy*

Examples: emergency light level on the floor), on the desk, on a book

Measured in: Foot-Candles (US) and Lux (Metric)

ALL GUIDES AND RECOMMENDATIONS LIGHT LEVELS ARE PROVIDED AS ILLUMINANCE (ie foot-candles)

Luminance: We See Brightness of Surfaces

*Measures how easy something is to see, or how bight a surface is – **emitting** or **reflected** light energy*

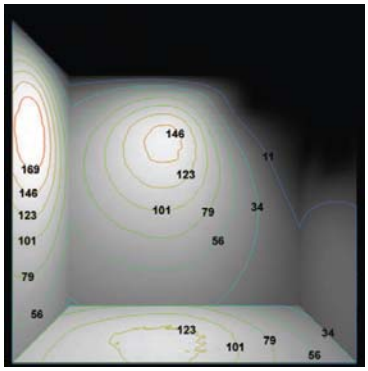
Examples: backlit signage, the moon, a glowing wall, the contrast on steps

Measured in: Foot-Lamberts (US) or Candelas per meter squared (metric)

1 Foot-Lambert = 3.426 Candelas/m2

9

Calculating Light



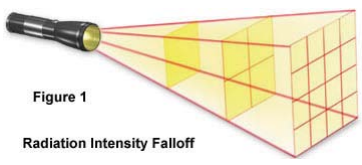


Figure 1

Radiation Intensity Falloff

The importance of Lighting Math:

- Calculations can determine the light levels
- Calculations can determine the required quantity of fixtures
- Calculations can verify uniformity

Methods to perform Lighting Math:

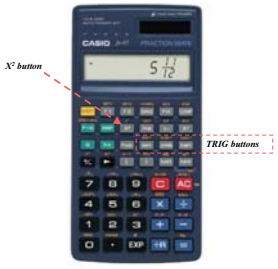
- By Hand - calculates a "**quick**" estimate of light levels, and verifies qty of fixtures
- By Computer - calculates a "**detailed**" estimate of light levels, and verifies qty of fixtures

10

Lighting a Task

Calculating Light

- *Bring the Following Items to Next Class….*



Scientific Calculator
- should have TRIG and X^2 functions
(familiarize yourself on how to use the functions)

Protractor

Architectural Scale

11

Lighting a Task Surface

12

Lighting a Task

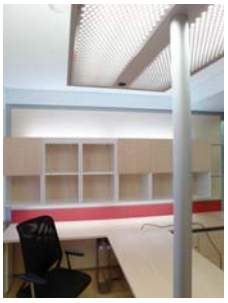
Lighting a Task Surface




13

Lighting a Task Surface





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Lighting a Task

Lighting a Task Surface




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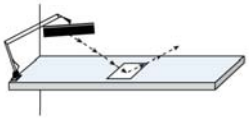
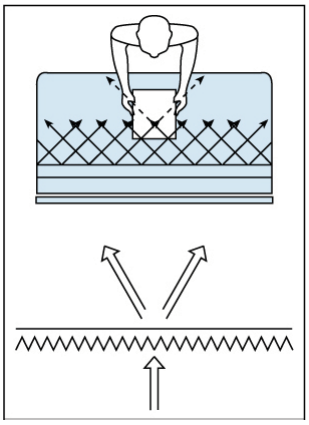
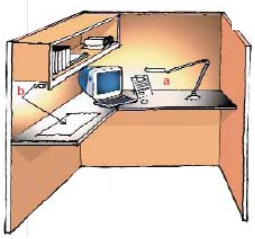
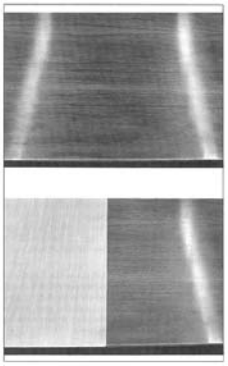
Lighting a Task Surface



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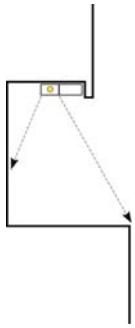
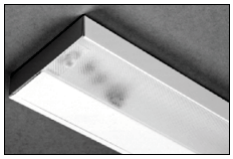
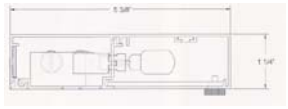
Lighting a Task

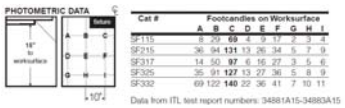
Lighting a Task Surface

Surface Mounted Fixtures:









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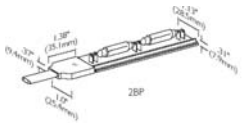
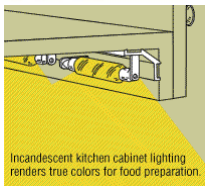
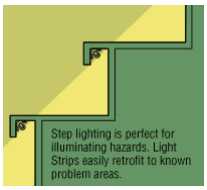
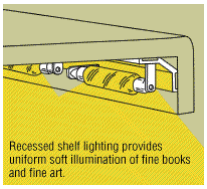
Lighting a Task Surface

Low Voltage Strips:

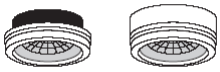


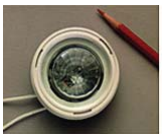






"Puk" Lights:





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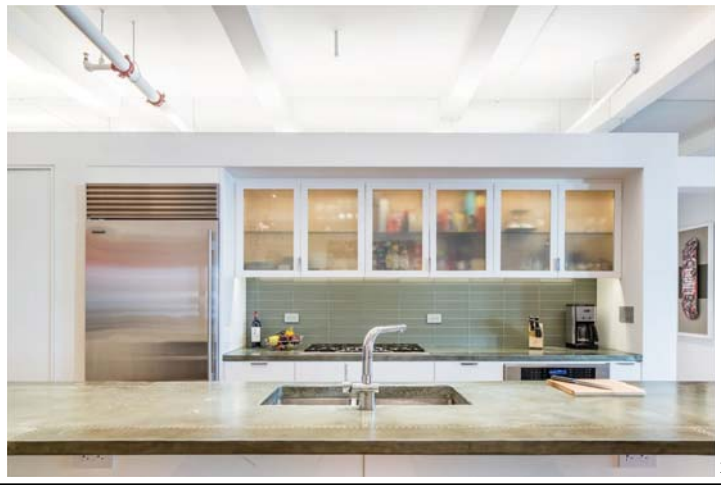
Lighting a Task

Lighting a Task Surface

Lighting a Task Surface



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Lighting a Task

Lighting a Task Surface

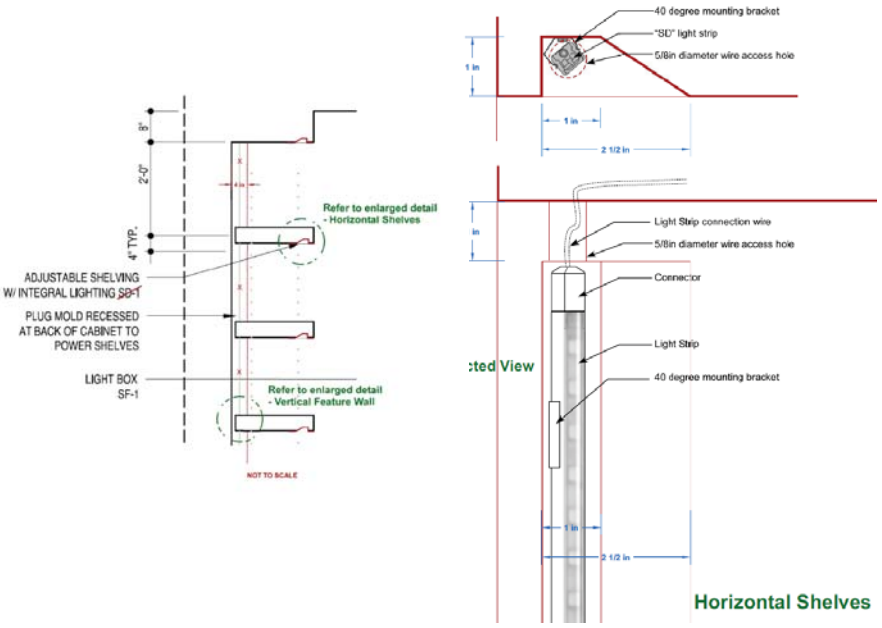
21

Lighting a Task Surface

22

Lighting a Task

Lighting a Task Surface



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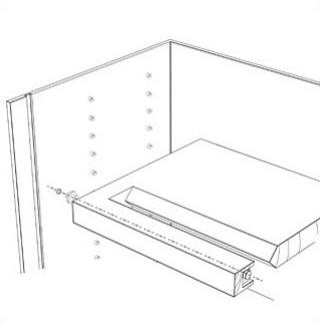
Lighting a Task Surface



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Lighting a Task

Lighting a Task Surface

25

Lighting a Task Surface

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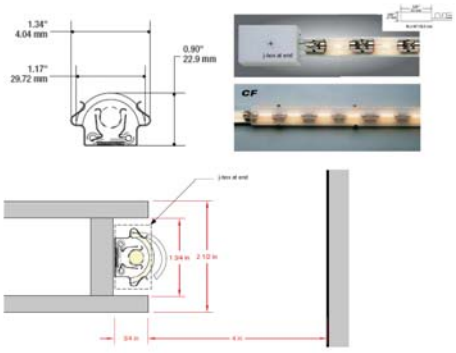
Lighting a Task

Lighting a Task Surface



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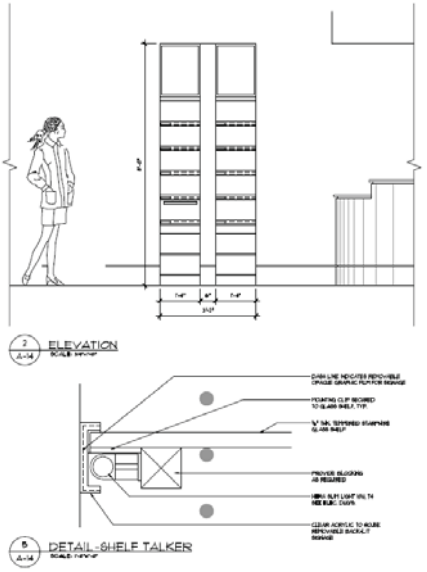
Lighting a Task Surface

28

Lighting a Task

Lighting a Task Surface



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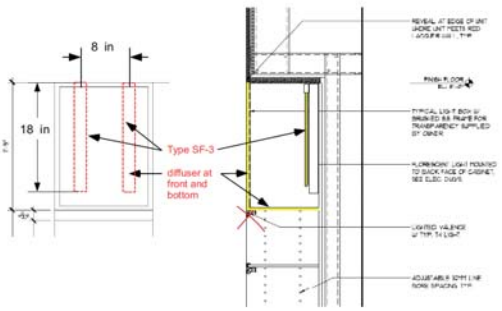
Lighting a Task Surface



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Lighting a Task

Lighting a Task Surface

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Lighting a Task Surface

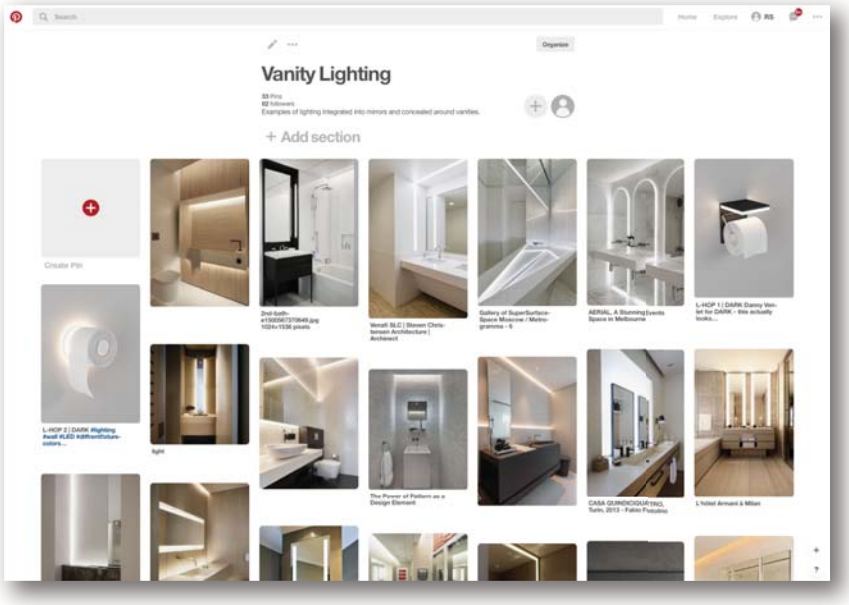
Lighting a Task

Lighting a Task Surface



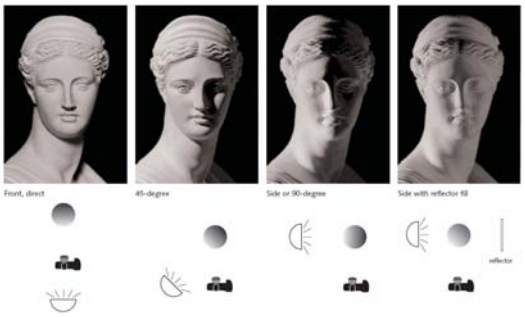


Lighting a Task Surface



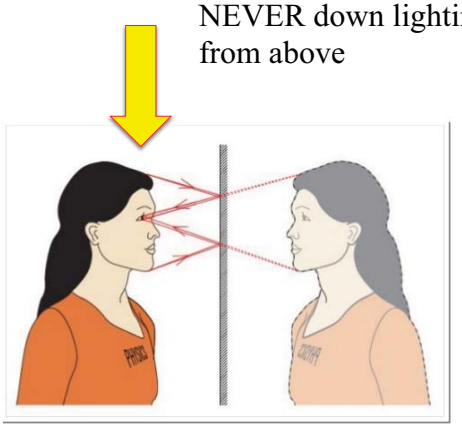
Lighting a Task

Lighting a Task Surface



Lighting a Task Surface

NEVER down lighting
from above

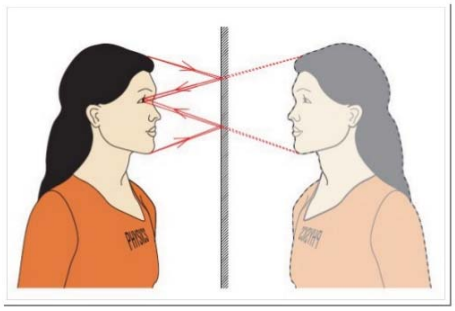


Lighting a Task

Lighting a Task Surface

ALL lighting should be…
- **Diffuse (soft, not to create shadows)**
- **High Color Rendering**

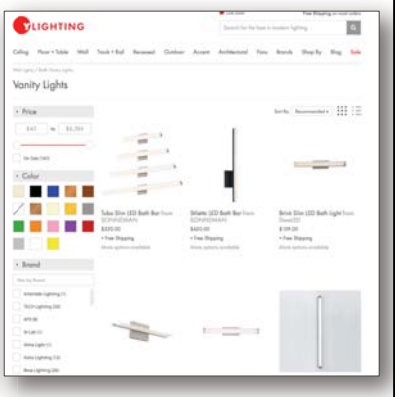
Wider than 12 in



Taller than 16in

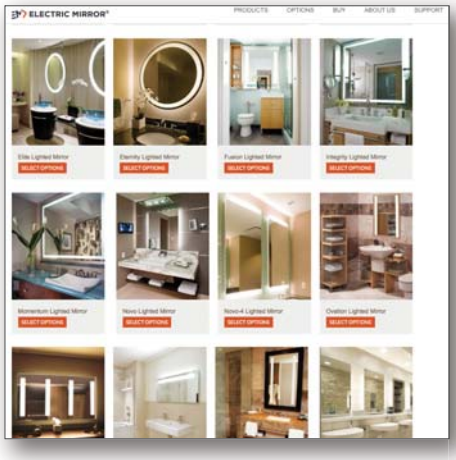
Light the Back wall

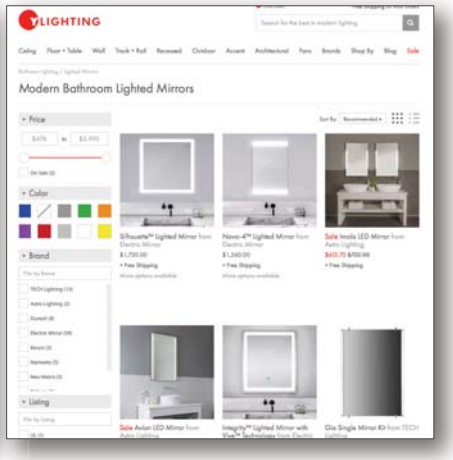
Lighting a Task Surface



Lighting a Task

Lighting a Task Surface





Lighting Quality

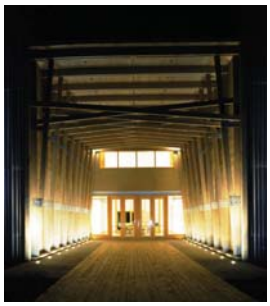
Patterns of light and dark affect both our perceptions of the world and our emotional and physiological responses, and thus they are essential in gathering information about the physical world.

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.



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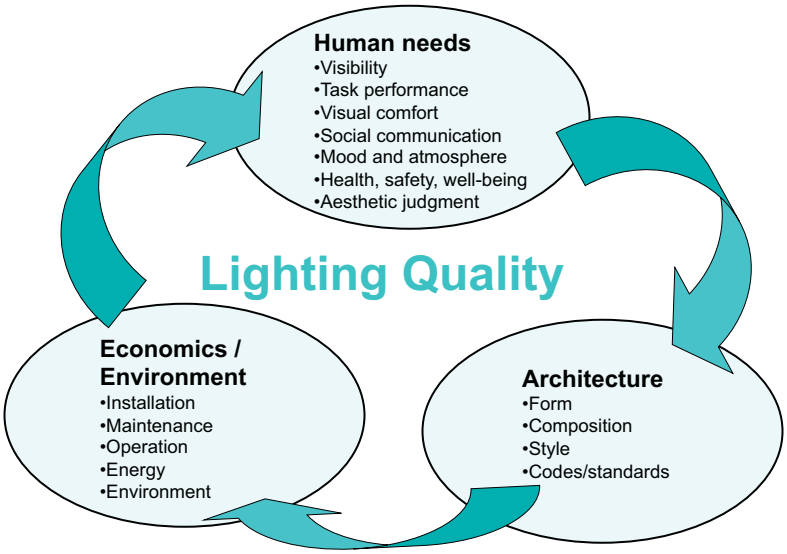
Lighting a Task

Lighting Quality



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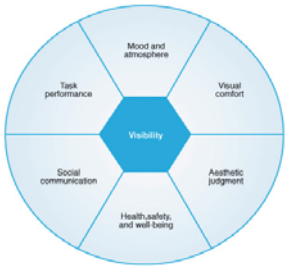
Lighting for Human Needs

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

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Lighting a Task

Lighting for Human Needs

Visibility

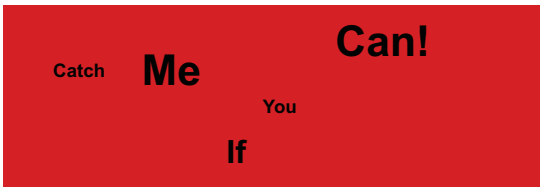
Visibility is the ability to extract information from the field of view, whether that information is the location of a curb or of a flower arrangement. It is a necessary condition for good-quality lighting.

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



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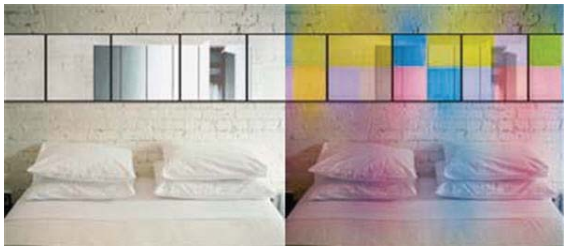
Lighting for Human Needs

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.



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Lighting a Task

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

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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.

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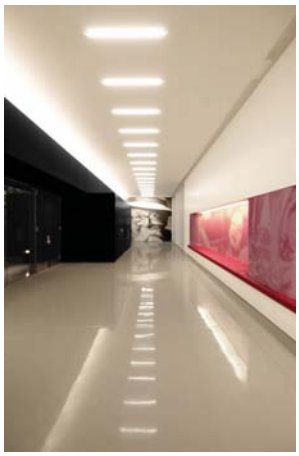

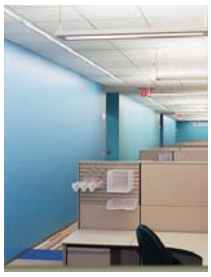

Good

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Lighting a Task

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




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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.



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Lighting a Task

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.

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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.

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Lighting a Task

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.





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