

Sophomore Architecture Lighting Lecture 3: Spatial Strategies / Light in Architecture Spring 2010

Sophomore Architecture Studio: Lighting

Lecture 1:

- Review of Daylight
- Introduction of Electric Light
- Survey the Color Spectrum
- Summary of Light Sources

Lecture 2:

- Controlling Light
- Effects on Materials

Lecture 3:

- Light in Architecture
- Lighting Design Strategies

Designing with Light

Lighting Designers, Architects, and Interior Designers are interested in the environmental impact of **light**.

Lighting Goals:

- Meeting the "vision" needs of the space (*lighting for what people need to do*)




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- Creating a sense of space, both physically, experientially, and psychologically




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Lighting Goals:

- Meeting the "vision" needs of the space (*lighting for what people need to do*)
- Creating an atmosphere
- Creating a sense of space, both physically, experientially, and psychologically
- Revealing materials and surfaces



Designing with Light



The majority of the information that we receive about the world around us comes through our eyes.

Light is not only an essential prerequisite, it is the medium by which we are able to see.

Through its intensity, the way it is distributed and through its properties, light creates specific conditions which can influence our perception. Lighting design is, in fact, the planning of our visual environment.

Summary

- *An understanding quality versus quantity*
- *Art and Science*
- *Utilization of Space*
- *Psychological Requirements*
- *Architecture and Ambience*

Good lighting design aims to create perceptual conditions which allow us to work effectively and orient ourselves safely while promoting a feeling of well-being in a particular environment.

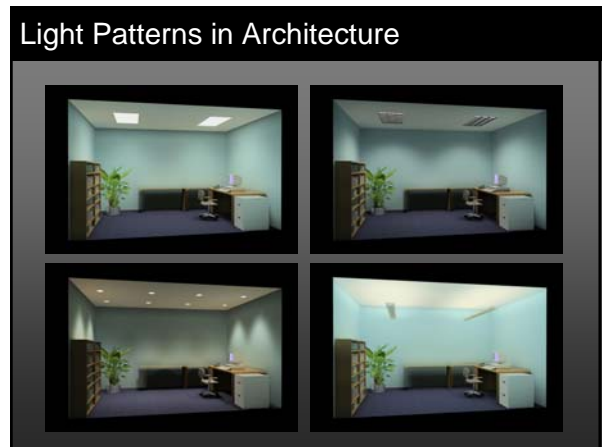
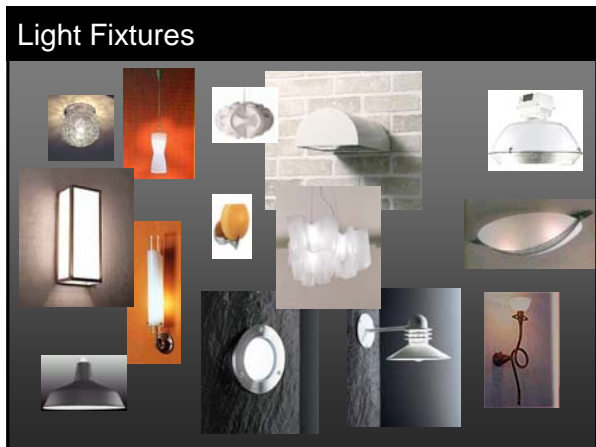
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Designing with Light

- Light plays a central role in the design of a visual environment.
- The architecture, people and objects are all made visible by the lighting.
- Light influences our well-being, the aesthetic effect and the mood of a room or area.
- It is light that first enables "what you see".

Our perception of architecture will be influenced by light:

- Light defines zones and boundaries,
- Light expands and accentuates rooms,
- Light creates links and delineates one area from another.



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Light Fixtures

- 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

horizontal

Light going Up / Indirect

Light going Down / Direct

Distribution of Light

Types of Distributions... by Light Fixture

Direct

Semi-Direct

General Diffuse

Direct-Indirect

Semi-Indirect

Indirect

Types of Distributions... by Light Fixture

Direct

Indirect

Direct-Indirect


Types of Distributions... by Light Fixture

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Types of Distributions... by Light Fixture

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Forming Functional Zones



- Large areas that on the whole are evenly illuminated can appear rather monotone if they are not divided up.


room illuminated evenly

Forming Functional Zones



unlit room


Forming Functional Zones



- Distinct contrasts between individual zones and their surroundings remove them from their spatial context.

room with left wall illuminated (simulate daylight)


Forming Functional Zones



- Light can be used to emphasize individual functional zones in an area, e.g. traffic areas, waiting areas, and exhibition areas.

room with rear walls only illuminated


Forming Functional Zones



- Light can be used to emphasize individual functional zones in an area, e.g. traffic areas, waiting areas, and exhibition areas.

room with objects only illuminated

Forming Functional Zones




- Light can be used to emphasize individual functional zones in an area, e.g. traffic areas, waiting areas, and exhibition areas.

room with stairs only illuminated

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Forming Functional Zones



- Zonal lighting with delineated beams of light visually separates one area from another.

room with objects and stair illuminated


Forming Functional Zones



- Different illuminance levels establish a perceptual hierarchy and direct the viewer's gaze.

room with left wall and stair illuminated equally


Forming Functional Zones



- Differentiated lighting of functional zones divide up an area and improve orientation.

room with rear wall and stair illuminated

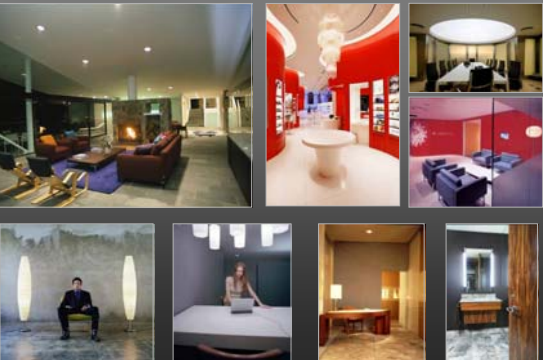
Forming Functional Zones



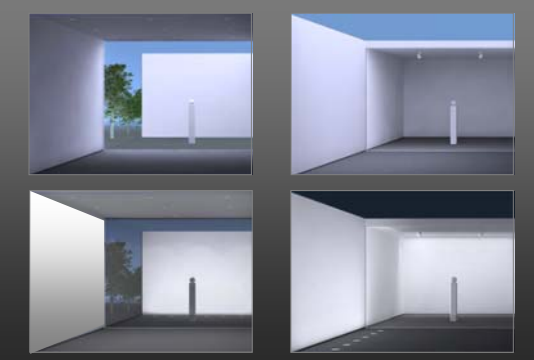
- The differentiation of light colors creates contrasts and emphasizes individual zones.

room with left and rear walls illuminated

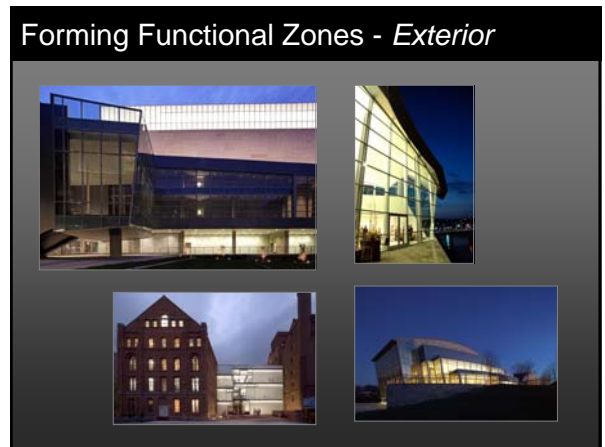
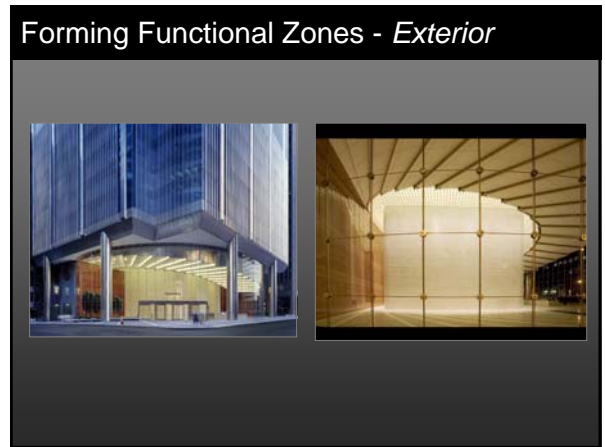
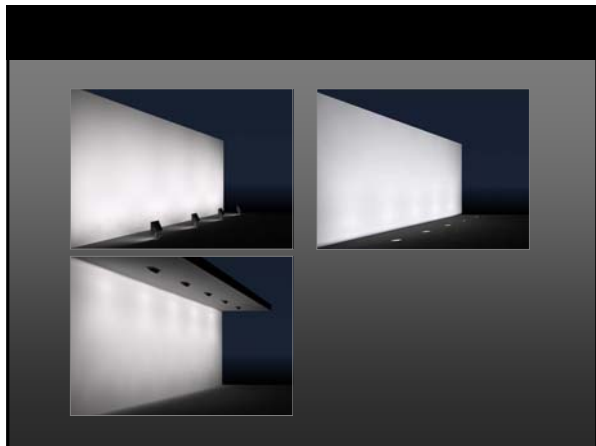
Forming Functional Zones



Forming Functional Zones - Exterior



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Forming Functional Zones - Exterior

Defining Spatial Borders - Horizontal

- Floor illumination emphasizes objects and pedestrian surfaces.

floor lit with downlight fixtures

Defining Spatial Borders - Horizontal

- Indirect lighting of a ceiling creates diffuse light in the room with the lighting effect being influenced by the reflectance and color of its surface.

ceiling uniformly lit with uplight wall fixtures

Defining Spatial Borders - Horizontal

Defining Spatial Borders - Horizontal


Defining Spatial Borders - Vertical

- Vertical spatial borders are emphasized by illuminating wall surfaces.
- Uniform light distribution emphasizes the wall as a whole.
- Bright walls create a high level of diffuse light in the room.
- Vertical illumination is used to shape the visual environment.
- Room surfaces can be differentiated using different levels of illuminance to indicate their importance.
- Uniform illumination of the surfaces emphasizes them as an architectural feature.

walls uniformly lit with wall fixtures


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Defining Spatial Borders - Vertical



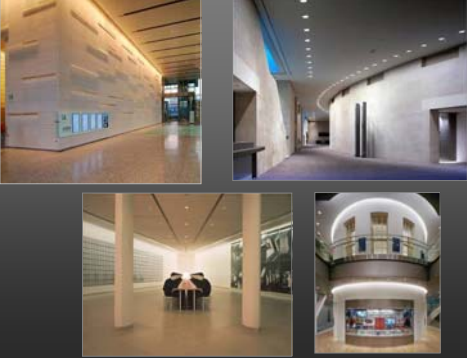
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Defining Spatial Borders - Vertical




- Grazing light gives the wall structure by adding patterns of light.
- A decreasing level of brightness across a wall is not as effective as uniform wall washing at defining room surfaces.
- Lighting effects using grazing light emphasis the surface textures and become the dominant feature.


Defining Spatial Borders - Vertical




Defining Spatial Borders - Vertical



Defining Spatial Borders - Vertical



Emphasizing Architectural Features




- The illumination of architectural details draws attention away from the room as a whole towards individual components.
- Columns appear as silhouettes in front of an illuminated wall.

walls lit with grazing fixtures

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Emphasizing Architectural Features



- Rooms can be given a visual structure by illuminating the architectural features.
- Narrow-beam downlights emphasizing the form of the columns.

columns lit with grazing fixtures

Emphasizing Architectural Features




- Grazing light accentuates individual elements or areas and brings out their form and surface texture.
- Grazing light can cause highly three-dimensional features to cast strong shadows.
- By using different levels of illuminance, different parts of a room can be placed in a visual hierarchy.


Emphasizing Architectural Features



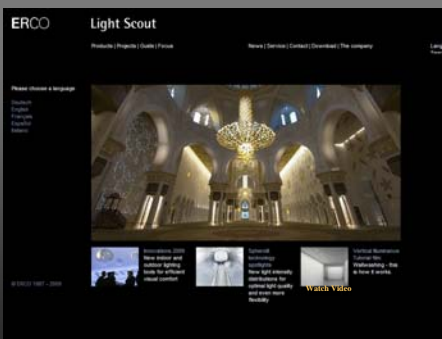
Visual Clarity



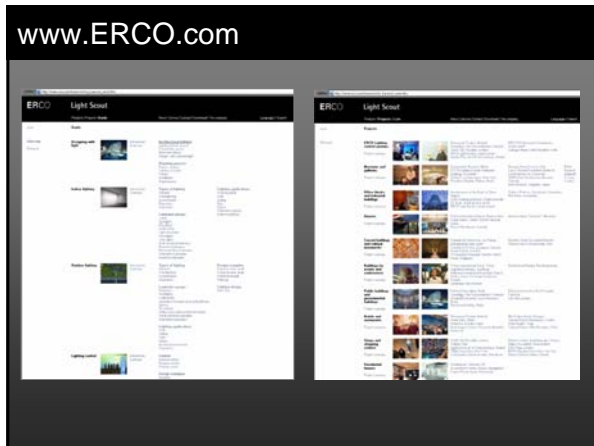
Visual Clarity



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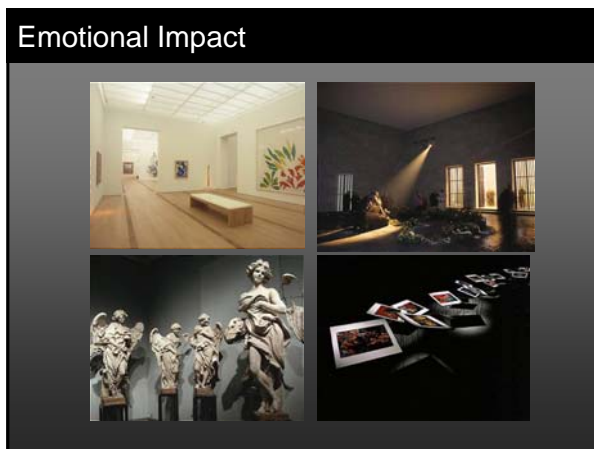
Psychology of Light

Because the sense of sight is contrast sensitive, the brightness contrast of a space determines its emotional impact

Emotional Impact: individual impressions of a space are a function of brightness contrast

- the relationship of surfaces that are lighted to those left in the dark
- the focus or foreground to the surround or background

General illumination in a room will permit vision. The emotional impact of an interior through the manipulation of brightness contrast is a real challenge for the creative lighting designer.



Degrees of Stimulation

All activities benefit from some form of visual stimulation

- High levels encourage participation and increase enjoyment
- Low levels help a person feel contented, comfortable, focused, and relaxed

Although individuals react differently to the same environment, there is a high degree of similarity in people's reactions to light.

Environments that are complex, crowded, asymmetrical, novel, unfamiliar, surprising, random are **High-load**.


Environments that are simple, uncrowded, symmetrical, conventional, familiar, unsurprising, or organized are **Low-load**.

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Degrees of Stimulation

Environmentalists use the terms **High-load** to **Low-load** to describe the degrees of stimulation of arousal.

The more stimuli that must be processed by a person, the higher the load.



Degrees of Brightness Contrast

The degree of brightness contrast evokes emotions in the same way as background music. It affects.....

- the performance of task,
- influences the behavior of people at work or play, and
- Impact the amount of containment and pleasure we experience.


The degree of brightness contrast establishes the emotional setting, which either enforces or undermines the intended activity.

Steps in the design process:

1. Define the activity that will occur in the space
2. Determine the degree of stimulation that will enforce the activity
3. Establish the degree of brightness contrast that will yield the necessary level of stimulation


Brightness contrast is established by developing patterns of light and shade – select which surfaces to receive light or leave other is darkness

Degrees of Brightness Contrast



The fact that a medium grey area will appear bright if it is bordered in black, or dark if it is bordered in white. This can be explained by the fact that the stimuli perceived are processed directly - brightness is perceived as a result of the lightness contrast between the grey area and the immediate surroundings.

The perception of brightness of the grey field depends on the environment - in bright surroundings, an identical grey appears darker than in dark surroundings.



What we are considering here is a visual impression that is based exclusively on sensory input which is not influenced by any criteria of order linked with our intellectual processing of this information.


Degrees of Brightness Contrast

Low Contrast Environment – *everything is of equal emphasis*




Degrees of Brightness Contrast

Low Contrast Environment – *everything is of equal emphasis*



Degrees of Brightness Contrast

Low Contrast Environment – *everything is of equal emphasis*



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Degrees of Brightness Contrast

Mid Contrast Environment – combinations of emphasis




Degrees of Brightness Contrast

Mid Contrast Environment – combinations of emphasis



Degrees of Brightness Contrast

High Contrast Environment – high bright and dark areas




Degrees of Brightness Contrast

High Contrast Environment – high bright and dark areas



Degrees of Brightness Contrast

Very High Contrast Environment – extreme high bright and dark areas



Degrees of Brightness Contrast

Very High Contrast Environment – extreme high bright and dark areas



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Designing with Light

Subjective Impressions

- Professor John Flynn's studies in the 1970's established fundamental research about how the distribution of light and resulting patterns of light effect our **subjective impressions** of a place.
- In particular patterns of light on vertical surfaces (because they are more noticeable) strongly influence our impressions of:
 - Spaciousness / Confinement
 - Visual Clarity / Haziness
 - Relaxation / Activation
 - Private/ Public

Subjective Impressions

- Direct lighting on table** strong contrast, too harsh for lighting faces
Pleasantness: Neutral
Clarity: Hazy, quiet impression
Spaciousness: Strong impression of confinement
- Lighting on all walls**, low intensity, suitable for display
Pleasantness: Neutral, tending towards a more pleasant impression
Clarity: Neutral
Spaciousness: Promotes impression of spaciousness, increased height
- Lighting of cove above**, low intensity, pleasant for near and distant faces
Pleasantness: Strong negative
Clarity: Strong promoting hazy, quiet impression
Spaciousness: Neutral
- Direct lighting on table, Lighting of small wall**
Pleasantness: Relatively Strong positive
Clarity: Neutral
Spaciousness: Neutral with strength in impression of length
- Direct lighting on table, Lighting of cove above** soft subdued effect, pleasant for near faces
Pleasantness: Relatively Strong negative
Clarity: Strong
Spaciousness: Somewhat
- Lighting of cove above, Lighting of walls** flat shadow free
Pleasantness: Strong
Clarity: Strong
Spaciousness: Strong

Subjective Impressions

Reinforced by

- Uniform peripheral lighting, especially on walls
- Brightness is reinforcing, but not decisive

SPACIOUSNESS

Lumiance 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)

Subjective Impressions

Reinforced by

- Higher light levels on horizontal surfaces: workplane, ceiling plane
- Light in central area of room
- Some wall luminance
- Cooler, white light

VISUAL CLARITY

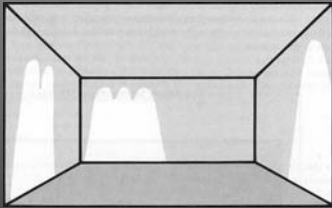
Lumiance Patterns

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)

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Subjective Impressions



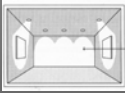
Reinforced by

- Non-uniform peripheral lighting, especially on walls
- Lower light levels
- Warmer-toned light sources


RELAXATION

Luminance Patterns

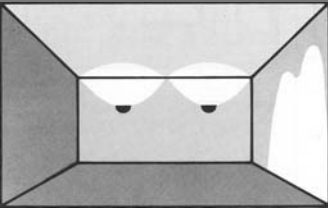
Relaxation:
Relaxation also implies non-uniform lighting, with non-uniform wall lighting contributing to this impression. Warm color sources contribute to a relaxing feeling. Aspects of the patterns for relaxation can be effectively combined with those for visual clarity to create effective and comfortable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



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

Subjective Impressions



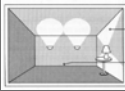
Reinforced by

- Non-uniform
- Lower brightness in zone of user
- Higher brightness in zones surrounding user
- Wall lighting


PRIVACY

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.



Non-uniform, high-brightness lighting on wall (to emphasize background)
Low brightness in area of occupancy



Subjective Impressions

Impression of Spaciousness – the room appears larger or smaller




Subjective Impressions

Impression of Perceptual Clarity – the room appears public or private

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Subjective Impressions

Impression of Pleasantness – *the room appears friendly of sociable*

The Three Elements of Light

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

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.

Light Distribution Strategies

General or Ambient Lighting:
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.

Local or Task 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.

Richard Kelly

Focal Glow or Task light is...

“the campfire of all time, the glowing embers around which stories are told”
“the light burning at the window or welcoming gleam of the open door”
“directive, creates a brighter center: tells us what to look at, organizes, marks the important element”

Richard Kelly

General or Ambient light is...

“a snowy morning in open country”
“twilight haze in a mountain top or cloudy day on the ocean”
“the light in a white tent at noon”

Richard Kelly

Sparkle or Glitter is...

“a play of brilliants”
“the sensation of a cache of diamonds in an opened cave”
“a ballroom of crystal chandeliers”