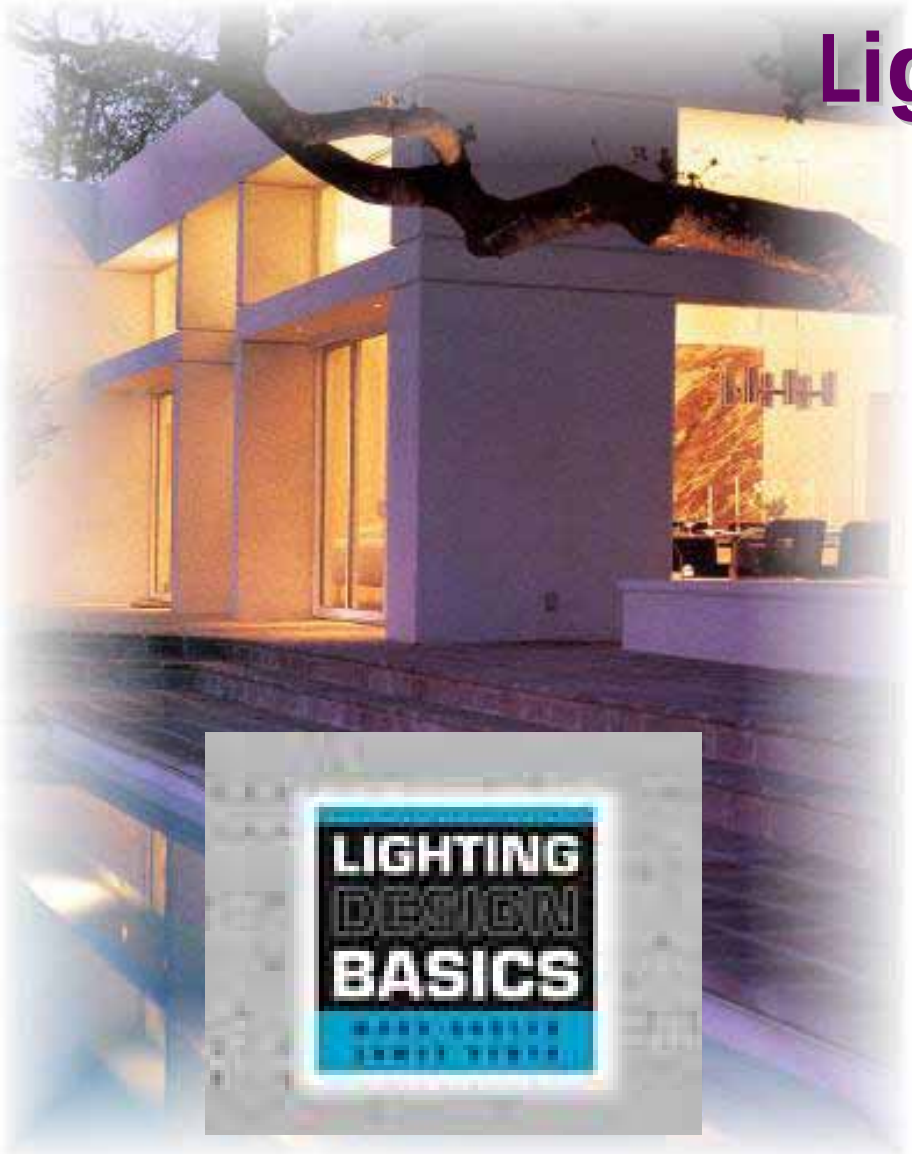


Lighting Design Basics

Based on the Book by Mark Karlen and James Benya, Wiley and Sons, 2004

Presented by
NKBA
and
Benya Lighting

James Robert Benya, PE, FIES, IALD, LC

BENYA LIGHTING DESIGN
Portland, OR

No Handouts?!?!?

- Get the book
  - www.wiley.com
- Download this presentation at www.benyalighting.com
- Questions? Send a message to jbenya@benyalighting.com

What are lighting design basics?

1. *Introduction*
2. *Light Sources*
3. *Luminaires*
4. *Switching and Dimming*
5. *Daylighting*
6. *Lighting Calculations*
7. *Documenting Lighting Design*
8. *The Layers Approach*
9. *A Basic Approach*

What are lighting design basics?

10. *Residential Lighting Design*
11. *Office and Corporate Lighting Design*
12. *Hospitality Lighting Design*
13. *Health Care/Institutional Lighting Design*
14. *Lighting for Stores*
15. *Lighting Common Spaces*

What are lighting design basics?

16. *The Professional Process of Lighting Design*
17. *Collaborating with Lighting Designers*
18. *Computers and Lighting Design*
19. *Developing Skills Beyond the Basics*

1 Introduction

A GOOD LIGHTING DESIGN SHOULD

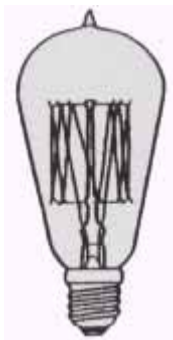
- **Look good!**
- **Provide the proper amount of light in every room.**
- **Be built and constructed within budget, code, and other constraints.**
- **Be environmentally responsible.**
- **Respond to the Architecture and Interior Design**
- **Produce good color**
- **Achieve the desired moods of each space**
- **Be able to control the lights**

2 Light Sources

- Incandescent
- Halogen
- Fluorescent
- Compact Fluorescent Lamps
- LED's
- Fiber Optic Sources

Incandescent Lamps

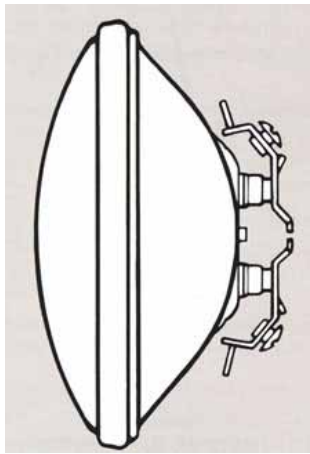
- **Appealing**
- **Warm, attractive color (2600-2900K)**
- **Dimmable**
- **Wide variety**
- **Not energy efficient**



Low Voltage Incandescent Lamps

- **Usually low wattage but not inherently energy efficient**
- **Greatest advantage: size**

Xenon incandescent strip lights 2800K



PAR36 Long throw display lamp 2700K

Low voltage strips and tubes 2400-2600K

Halogen Lamps

- **Appealing**
- **Crisp warm, attractive color (2800-3100K)**
- **Dimmable**
- **Wide variety**
- **Longer life, slightly more energy efficient**

Halogen PAR 20, PAR 30 and PAR 38 lamps

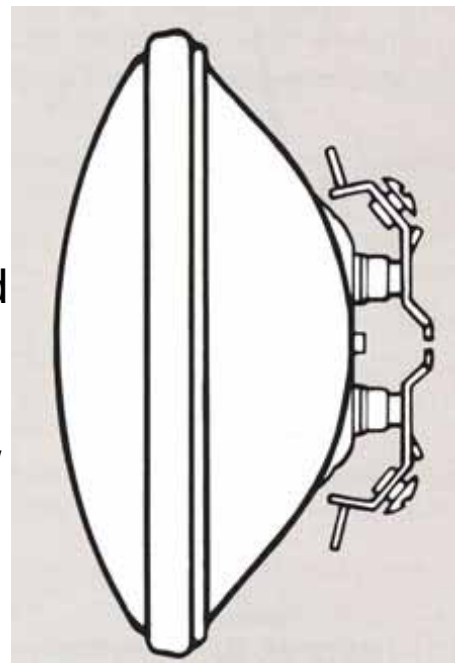
Halogen lamps for table lamps and chandeliers

Low Voltage Halogen

- **Compact, bright lamps**
- **A bit more energy efficient**
- **Excellent reading, work and display light sources**
- **Color Temp: 2900-3100K**
- **Long life**

Small halogen lamps for task lights, sconces, etc.

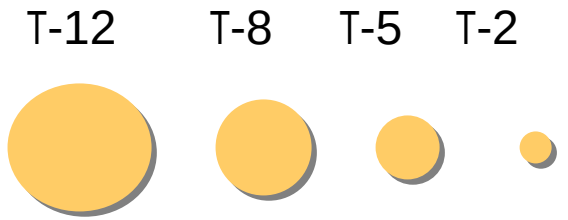
PAR36 and AR111 halogen long throw lamps



MR16

Linear Fluorescent

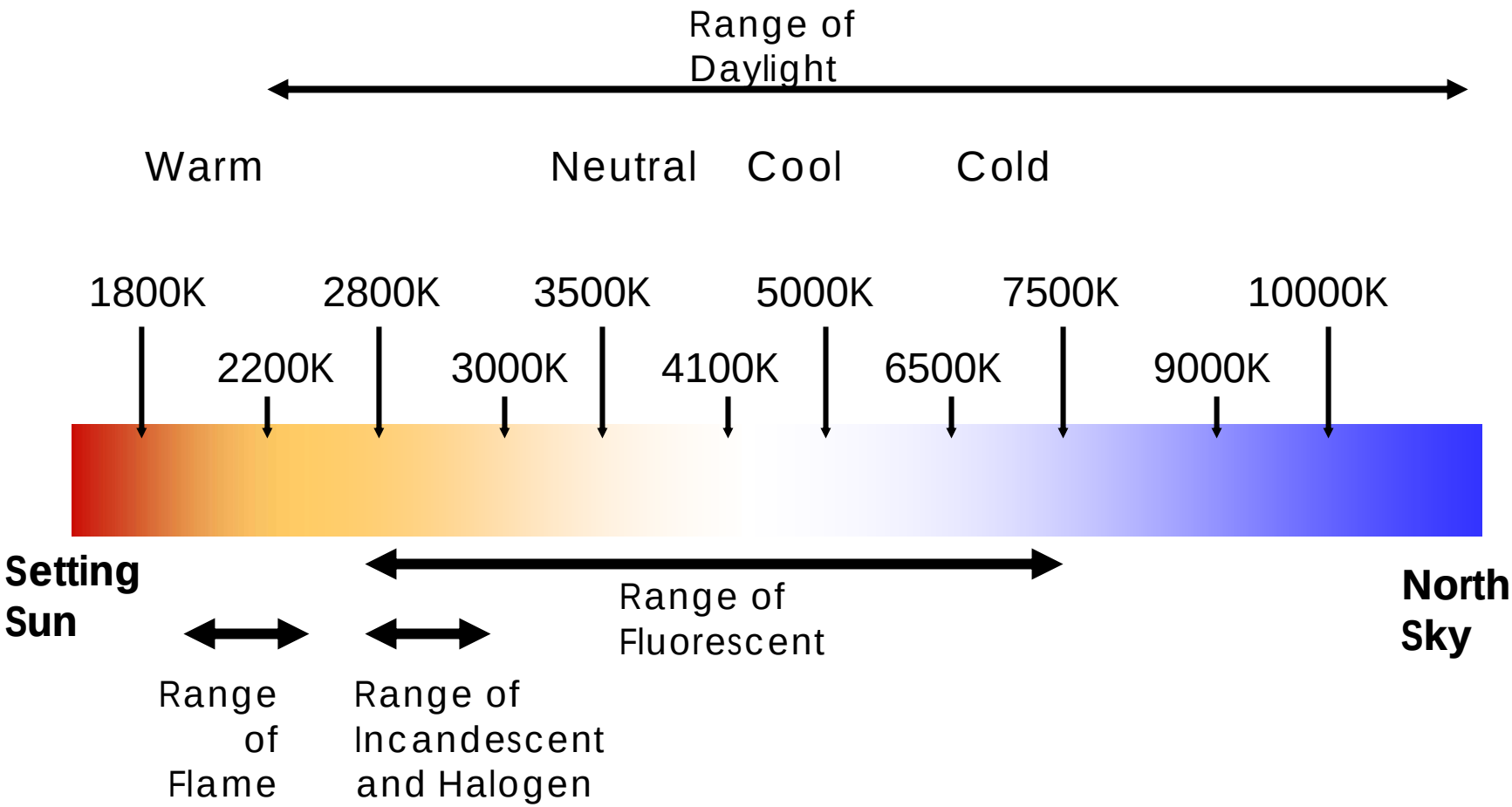
- **T-12 “fat tubes” no longer a good choice**
- **Use T-8 lamps for most residential uses**
- **Consider T-5 and T-2 lamps for undercabinet fixtures**



Compact Fluorescent

- 7,9, and 13 watt twin tubes (“PL” lamps) for step lights, low level lighting
- Triple tube, Circuline and 2D lamps 18-58 watts for general lighting

Color temperature



Recommended Fluorescent Lamps for Common Use

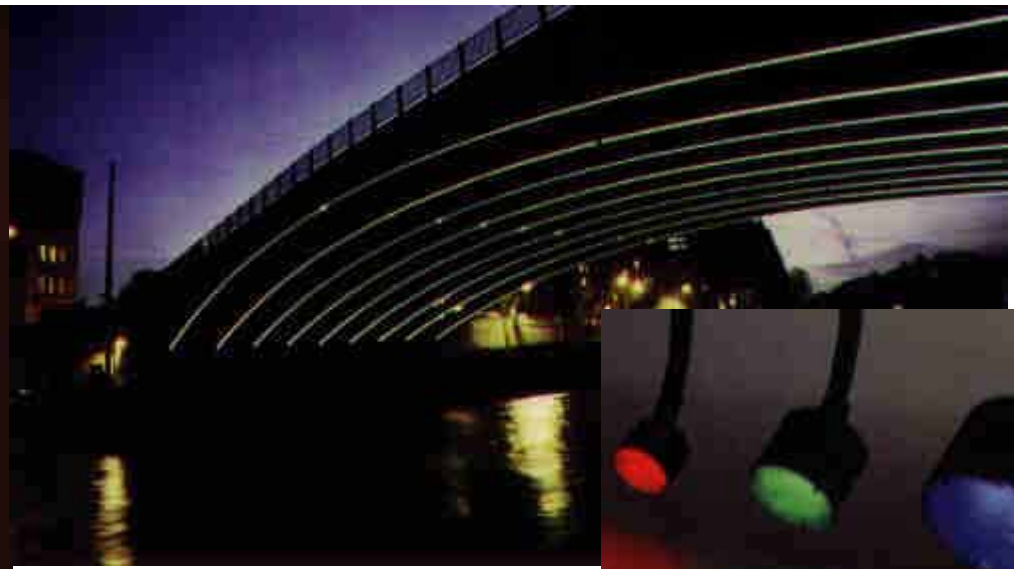
Desired Lamp Color	Lamp Color Designation
• Warm 2700K	• “827”
• Warm 3000K	• “830” or “930”
• Neutral 3500K	• “835”
• Cool 4100K	• “841”
• Cold 5000K	• “850” or “950”

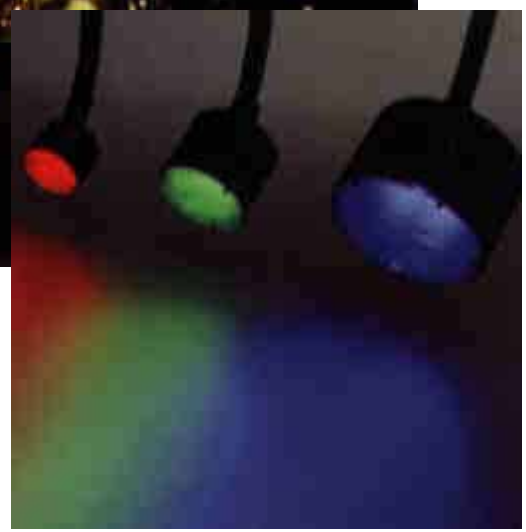
Example: F32T8/830 is a 3000K, 32 watt tubular fluorescent lamp 8/8” in diameter

Fluorescent Ballast Technology

- Non-dimming electronic ballasts
  - Quieter
  - Instant starting
- Dimming electronic ballasts
  - Two wire versions now available
  - Standard 3 wire and 4 wire versions also available

New Technologies

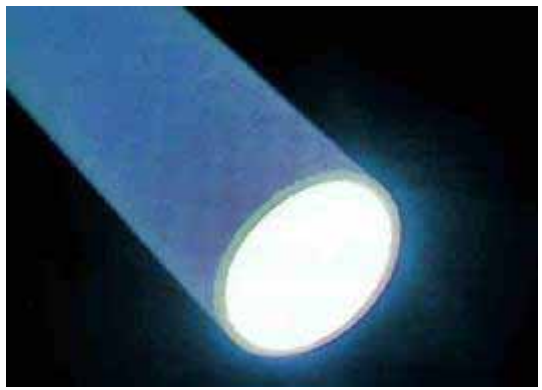




- Fiberoptics
- LED

Fiberoptics as Special Effect

- **End-emitting fiber**
  - **twinkle effects (star fields)**
  - **in-water effects (ponds and water features)**
- **Side Emitting fiber**
  - **outlining**
  - **shapes**

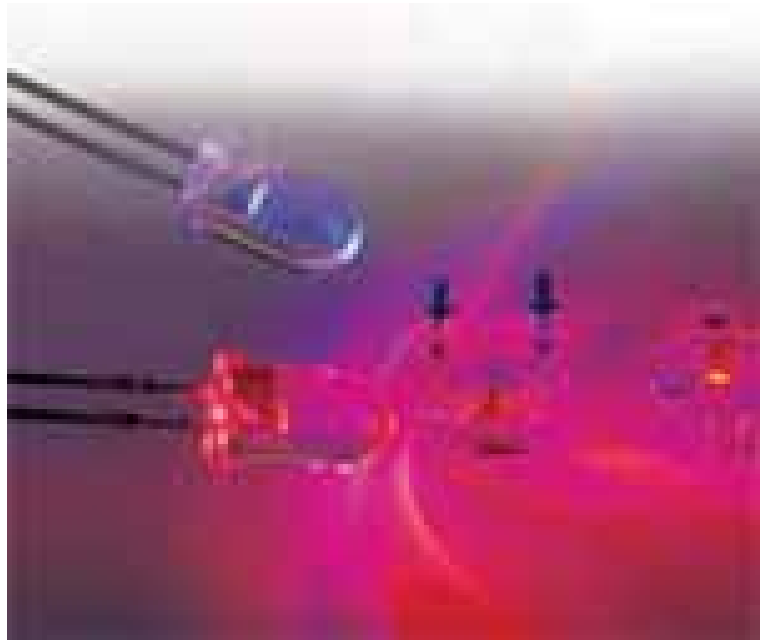


Fiberoptics as Display Lighting

- Uses special optical elements (small lenses)
- Each fiber emits a very small amount of light
- Maximum bundle is about 300 cd at 30 degree
- Virtually no UV or IR
- Requires a low ambient light space like a fine museum

LED Lights

- Promising technology
- Used for traffic signals and exit signs
- New products include sconces, step lights and marker lights



For the Kitchen and Bath
My favorites

Kitchen

- PAR38 halogen work area downlights
- MR16 low voltage accent lights
- Low voltage xenon or fluorescent undercabinet lights
- Fluorescent cove lights

Bath

- Halogen or fluorescent vanity lights
- MR16 vanity downlight and accent lights
- MR16 shower light

Urban Living Trends

- Smaller, higher quality spaces
- Green design

Challenges of Green Design

- Too much emphasis on compact fluorescent lighting
- Little understanding of lighting design by utility and energy efficiency advocates
- Not many good choices of luminaires embodying green principles
- Poor design sensitivity in the green community

For the Kitchen and Bath
My green favorites

Look for US EPA Energy Star but be picky!

Kitchen

- Compact fluorescent work area downlights
- MR16 low voltage accent lights
- Low voltage fluorescent undercabinet lights
- Fluorescent cove lights

Bath

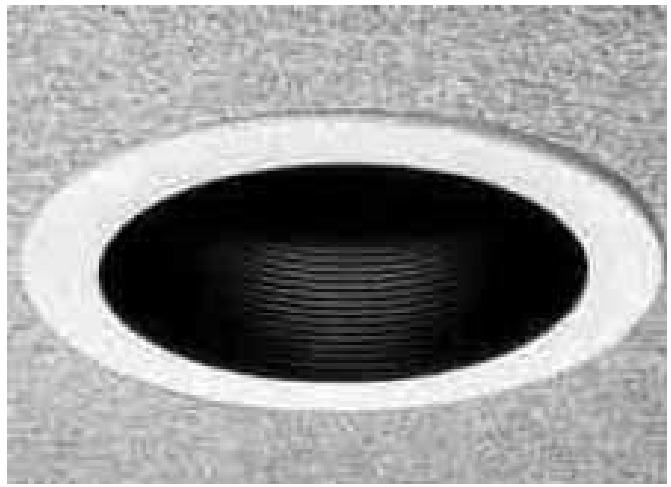
- Fluorescent vanity lights
- MR16 vanity downlight and accent lights
- MR16 shower light

3 Luminaires

- "Architectural"
  - Recessed cans
  - Track
  - Coves and undercabinet lights
- Decorative
  - Chandeliers
  - Sconces
  - Pendants
  - Lamps
- Utility
  - Drums
  - Closet lights

Recessed Lighting

- Generally inexpensive
- Very popular
- Aesthetically “neutral”
- Good for task lighting
- OK for general lighting
- If chosen correctly, excellent for display lighting and a number of special applications



Recessed Lighting

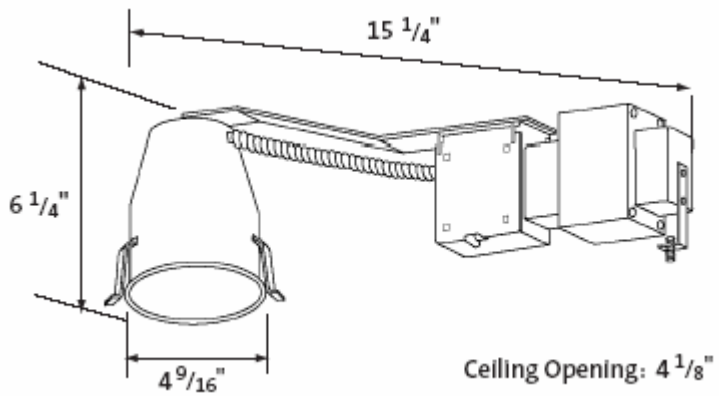
- The “Housing”
  - For most residential use, fixtures are at most about 7” tall for 2x8 construction
- The “Trim”
  - 4”, 5” and 6” incandescent
  - 3”, 4”, 5” and 6” low voltage
  - 4”, 5” and 6” compact fluorescent

Standard Housings

- Incandescent non-IC
- Incandescent IC
- Incandescent air tight IC
- Low voltage non-IC
- Low voltage IC
- Low voltage airtight IC
- Compact fluorescent non-IC
- Compact fluorescent IC
- Compact fluorescent airtight IC

Remodeler Housings

- Designed to fit through a single hole in the ceiling
- Usually not IC



Premium Housings

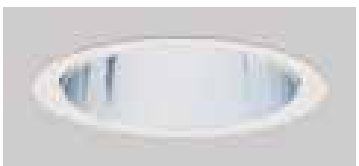
- Superior quality
- Interchangeable lamp capability
  - Incandescent
  - Low voltage
  - Compact fluorescent
- High quality interchangeable trims

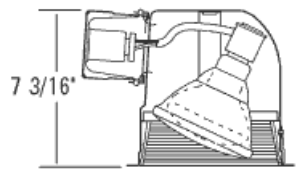
Choosing Trims

- Is the trim suitable for your needs
  - Adjustable?
  - Right style?
  - Right color or material?
- Is the trim LISTED for the application?
  - Kitchen: indoor, dry location
  - Bathroom: indoor, dry location
  - Over shower or tub: Spa or shower rated
  - Steam shower: wet label, gasketed
  - Indoor pool or hot tub: wet label, non conductive trim, at least 7.5’ above water level

Standard trims

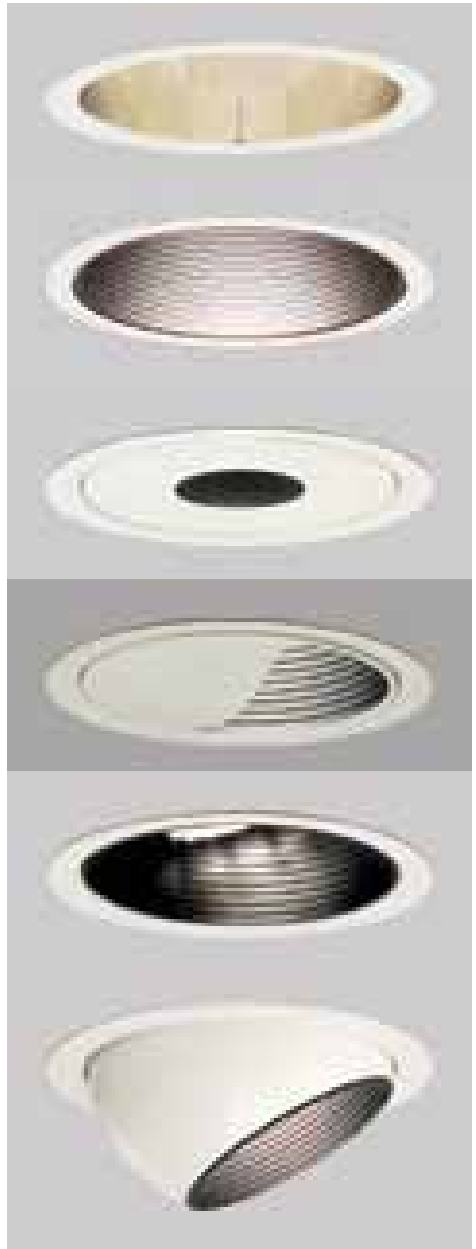
- **Downlight**
  - Baffle
  - Cone
- **Accent light**
  - Gimbal
  - Eyeball
  - Pull down
- **Wallwash**
  - Eyelid



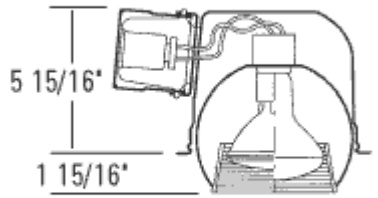


Using Standard Recessed Lighting

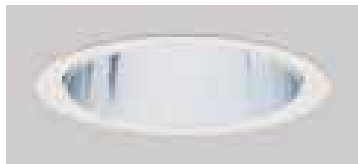
- Choose trims tastefully
- Use halogen lamps
  - 4” family use PAR20
  - 5” and 6” family use PAR30
  - 6” family also consider the PAR38
  - Avoid so called line voltage MR16 and PAR16

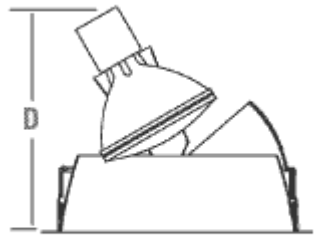


Adjustable Line Voltage Recessed Trims

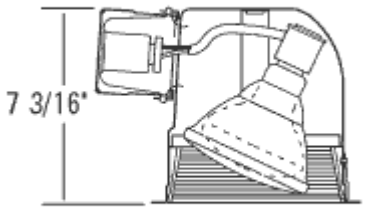


Vertical Tilt: 40°





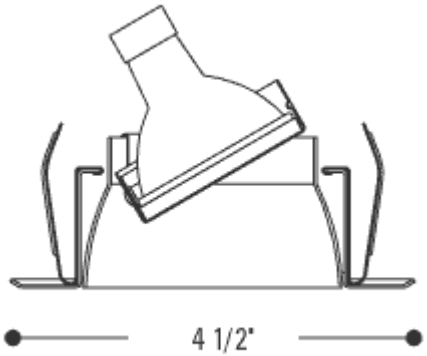
Vertical Tilt: 35°

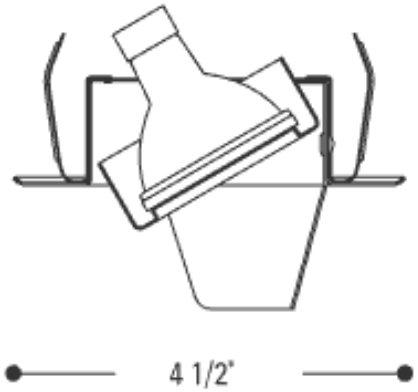


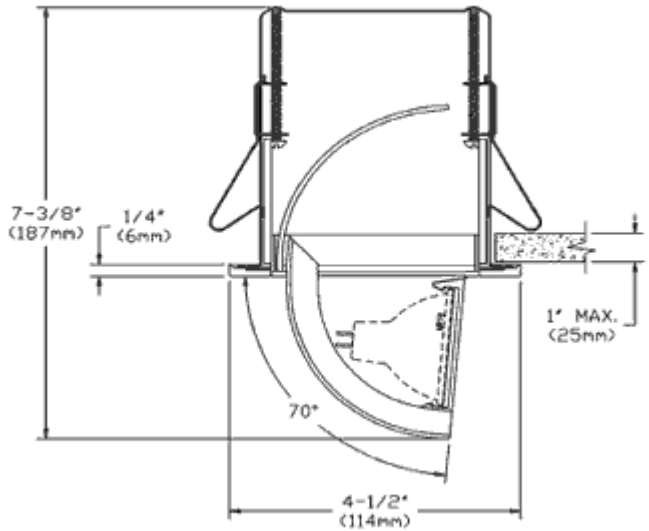
Vertical Tilt: 30°

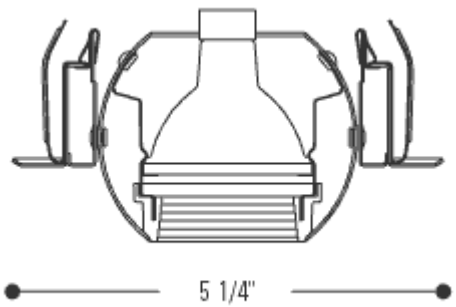
Low Voltage MR-16 Lighting

- Typically used in a 3” or 4” recessed can
- Can be used (with the right trim) in a 5” or 6” can
- Use good quality MR16 lamps
- ALWAYS use a soft focus spread lens (Halo L111)
- Current Favorite: Sylvania 37MR16/IR









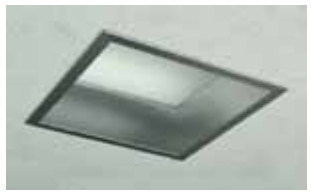
Low Voltage Trims

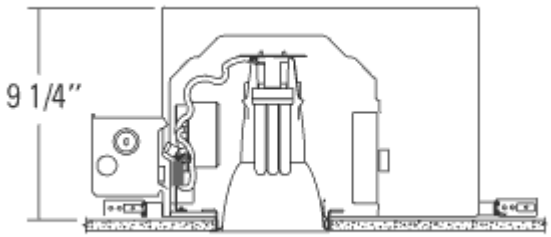
Other Low Voltage Trims

- Glass trim, gasketed for wet environments
- Low cost spa and shower light for tubs and shower stalls

Be Careful with Compact Fluorescent Downlights

- Square: not IC or AT but looks nice
- Round IC – way tall
- To get an airtight IC you are limited to 13 watts
- In the kitchen downlight you need 32 watts





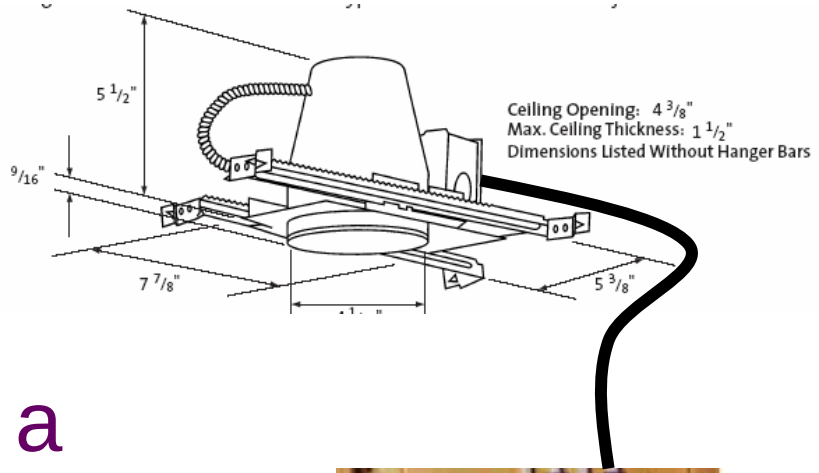
Track

- Still used in museums for good reason
- Permits maximum flexibility
- Luminaires equipped easily with spread lenses and UV filters for artwork lighting
- Attaches to surface, permits dramatic lighting in condos

Track

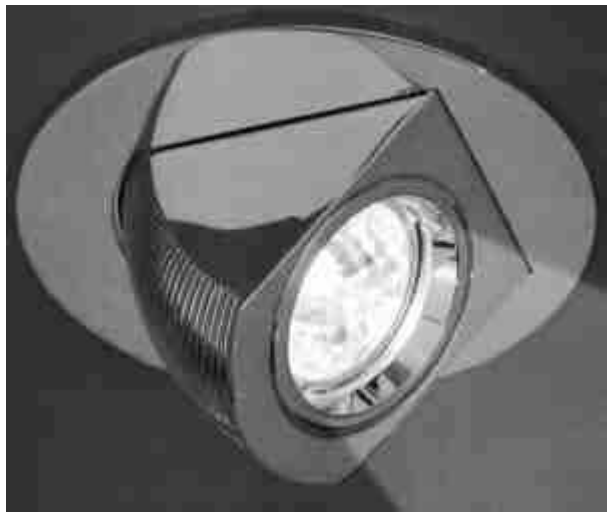
- Standard 120 volt track
  - Low cost general purpose
  - High cost “museum grade”
- Low voltage track
- Low voltage specialty systems
  - Two cable systems
  - Two rail systems
  - Two conductor “bars”, “rods”, and ribbons

Low Voltage Lighting



- Most recessed low voltage lights have a transformer in the housing
- Most low voltage strips and some recessed housings can be connected to a remote transformer

Accent Lighting Using Low Voltage



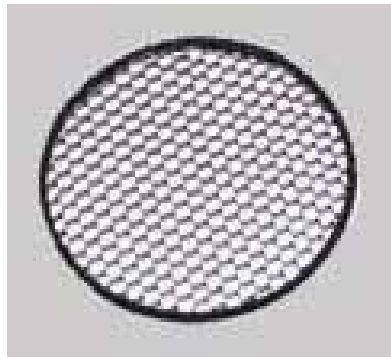
Beam Quality

An unfiltered lamp tends to have

- **Striation**
  - **lines and harsh edges**
- **Halation**
  - **rings sometimes with rainbowing**
- **Sharp edges and rapid change**
  - **well defined round or elliptical beams**

Taming the (MR16) Beast

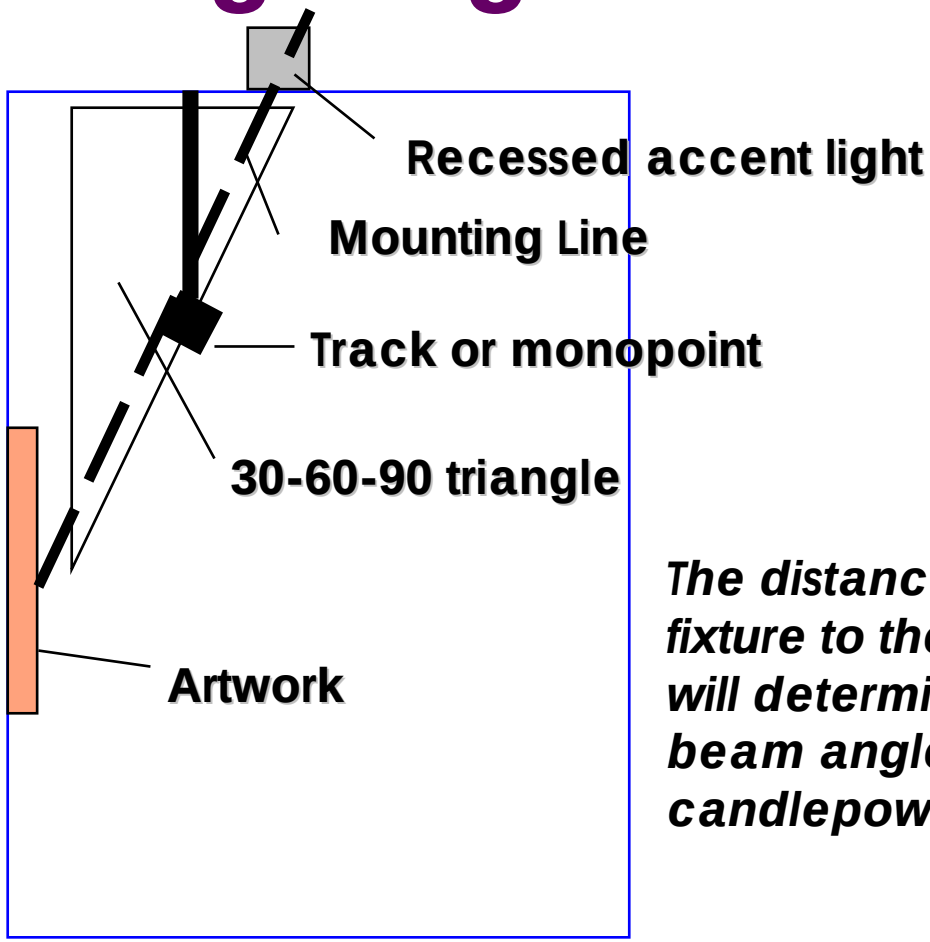
- **Smooth the Beam**
  - Softening Lens (Halo L111 or “solite”)
  - Spread Lens
  - Linear Lens
- **Shield the Source**
  - Baffle or snoot
  - Louver



Accent Lighting Technique

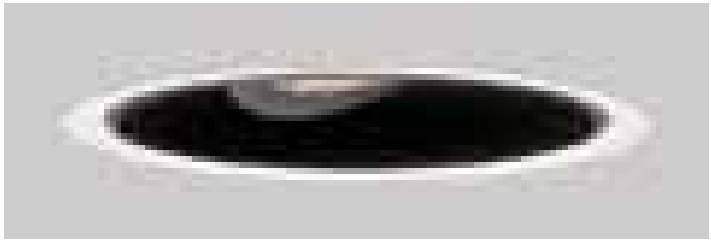
- Should be located at about 30 degrees off vertical relative to focal point
- Do not get too close to wall - normally 24” minimum away
- Use 30-60-90 triangle to determine optimum position
- Only use lighting systems capable of hitting above 40 degrees (off vertical) in special situations.

Accent Lighting

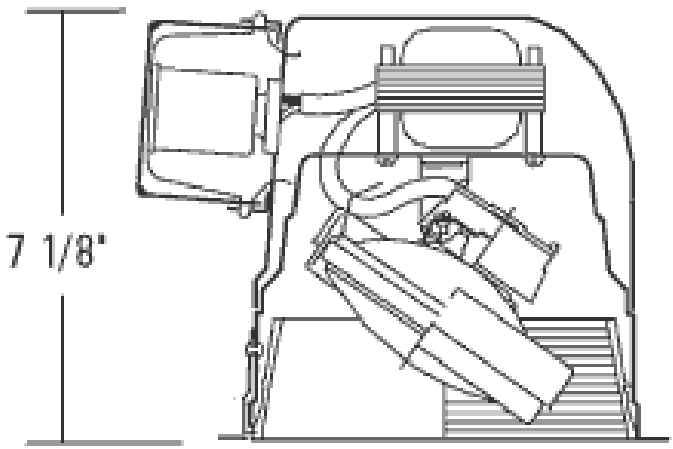


The distance from the fixture to the artwork will determine beam angle and candlepower

Accent Lighting with PAR36



For high ceilings use a low voltage 6” recessed luminaire and a 50 watt PAR36 low voltage lamp

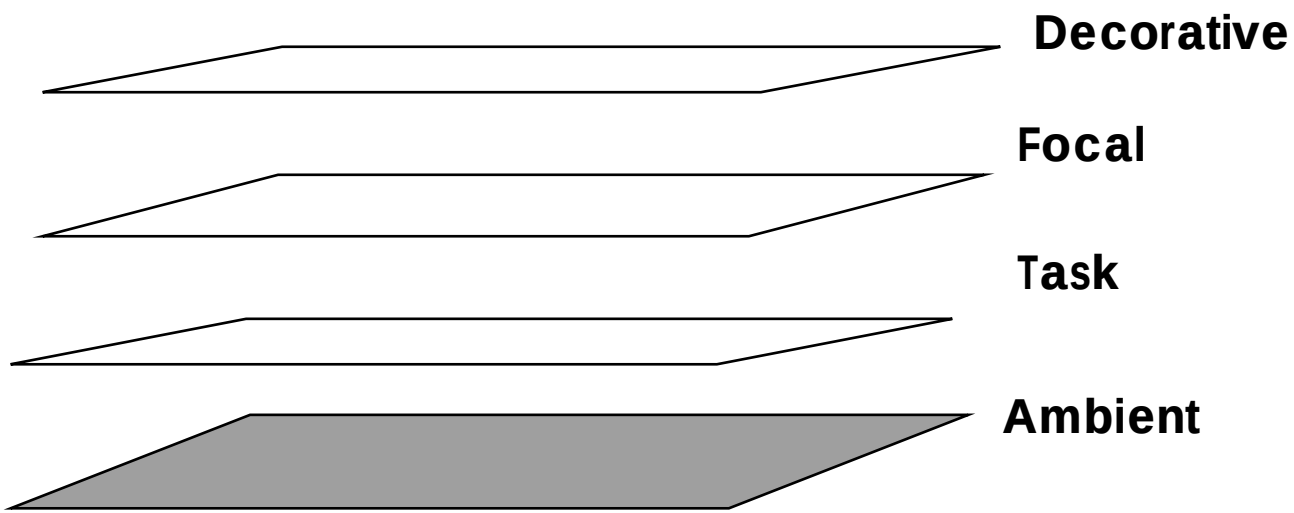


Accent lighting

- Living room, great room, family room
- Dining room
- Foyer
- Hallways/prime art locations
- Art niches
- Master bedroom reading and art lights
- Powder rooms

The Layered Approach to Lighting Design

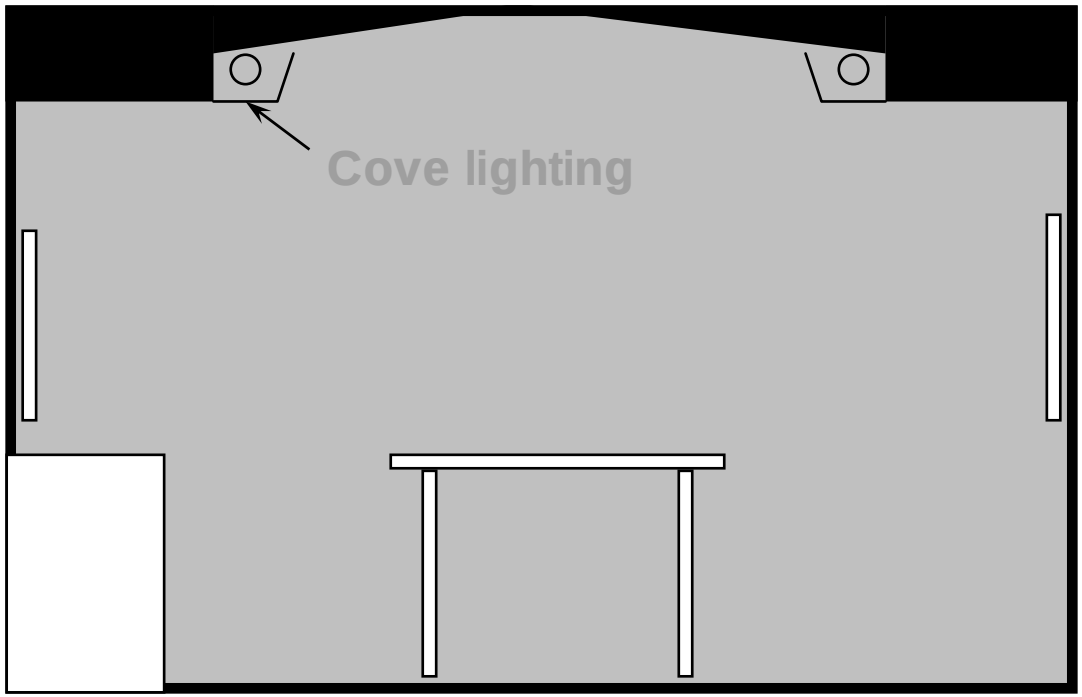
Begin by thinking in layers



Layer #1 - The Ambient or General Lighting Layer

- Generally the relatively uniform lighting of the space.
- Tends to establish mood.
- Includes uniform downlighting, indirect lighting (uplighting and wallwashing), and some special techniques, but can also be the decorative lighting
- Called “general lighting” if at task levels (30-50 fc or more).
- Called “ambient lighting” if lower than task levels

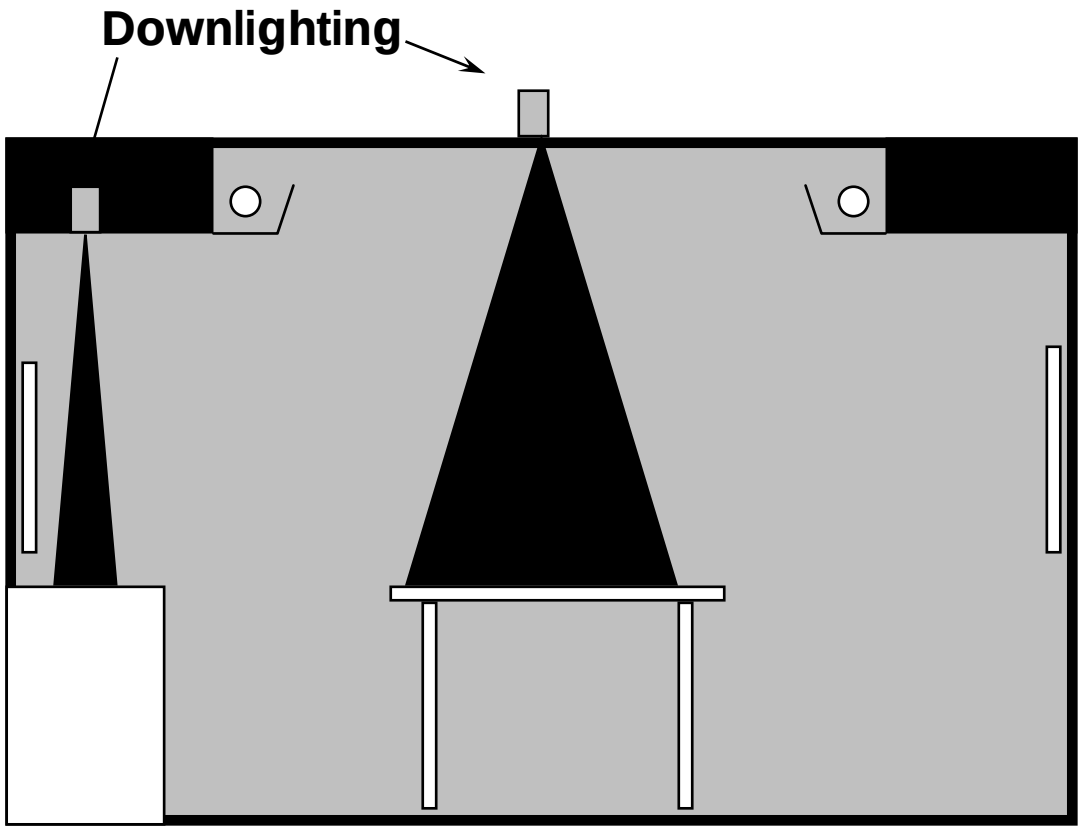
The Ambient Layer



Layer #2 - The Task Layer

- Generally limited to “task lighting” of the HORIZONTAL WORK SURFACE at work locations.
- Tends to help create drama.
- Usually produces 50 fc or more within a small area.

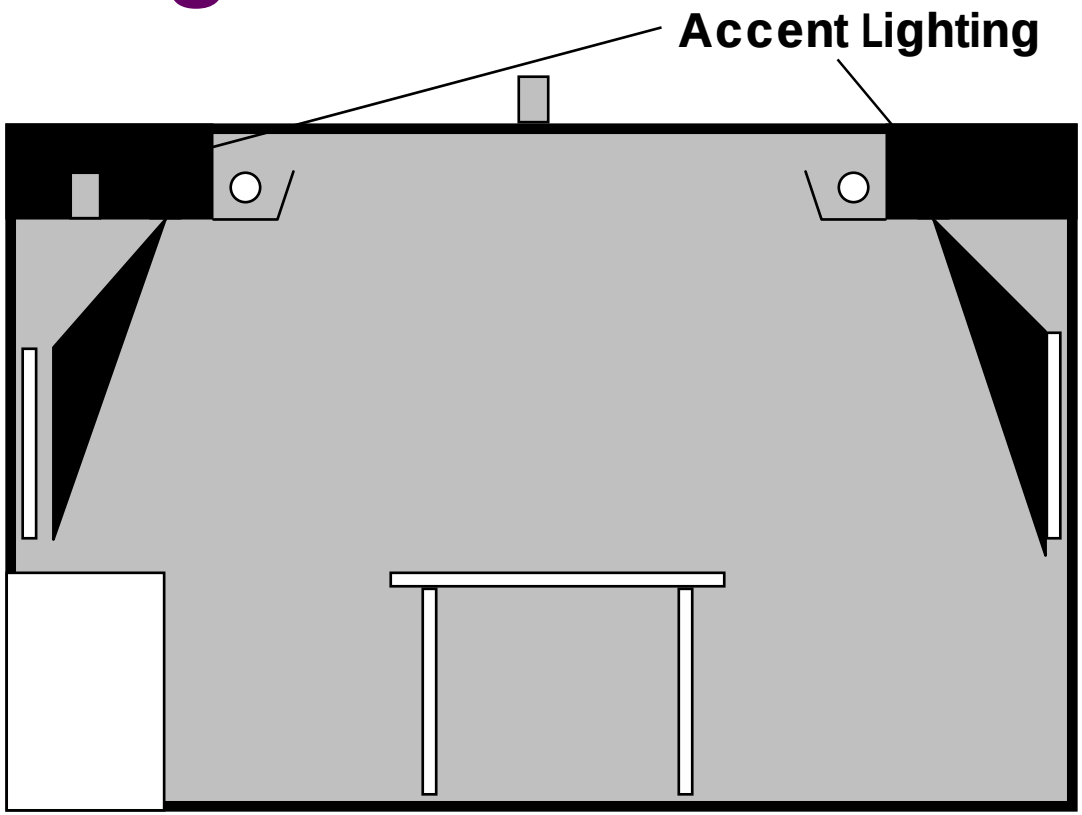
Ambient and Task Lighting



Layer #3 - The Display or Focal Layer

- Generally limited to accent lighting and similar effects, primarily through VERTICAL AND OTHER NON-HORIZONTAL SURFACE ILLUMINATION.
- Tends to create drama, with greater drama the result of greater contrast between the brightness created by Focal Lighting and Ambient Lighting.
- Usually involves key displays at 100 fc or more.

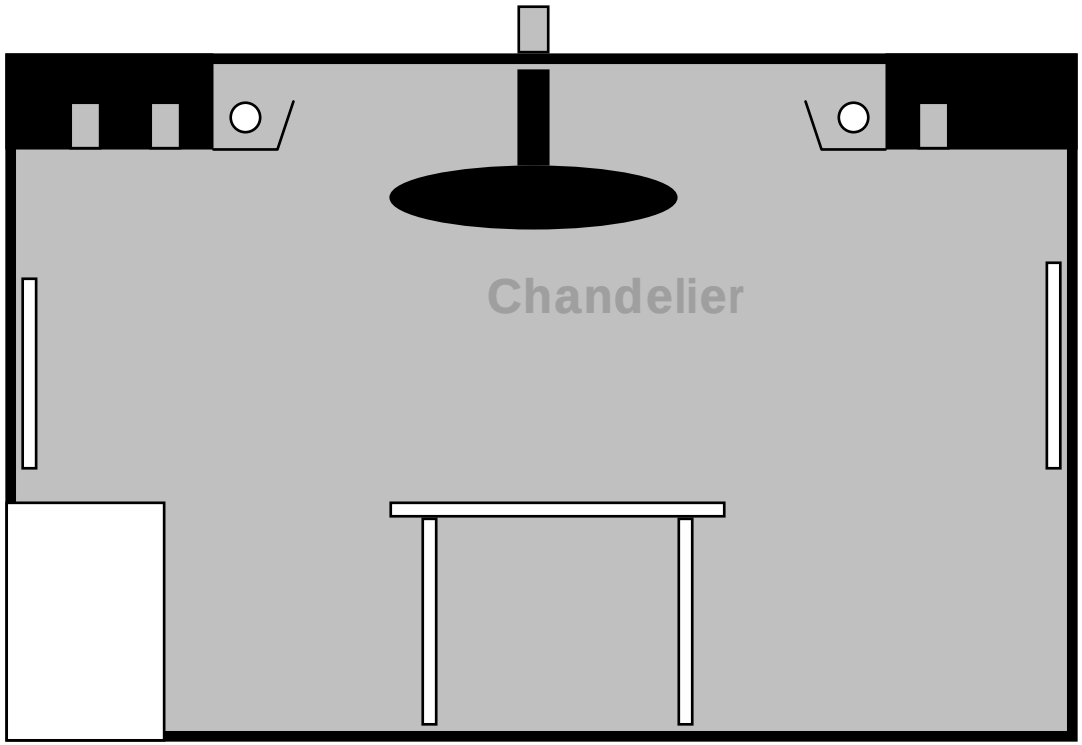
Ambient, Task and Focal Lighting



Layer #4 - the Decorative or Traditional Layer

- In general, adds the decorative luminaires called for by the architecture/interior design style, period, motif.
- Is usually expected to contribute to the ambient illumination. In many designs, the decorative lighting will BE the ambient lighting.
- Usually reduces contrast (drama).

Ambient, Task, Focal and Decorative Lighting



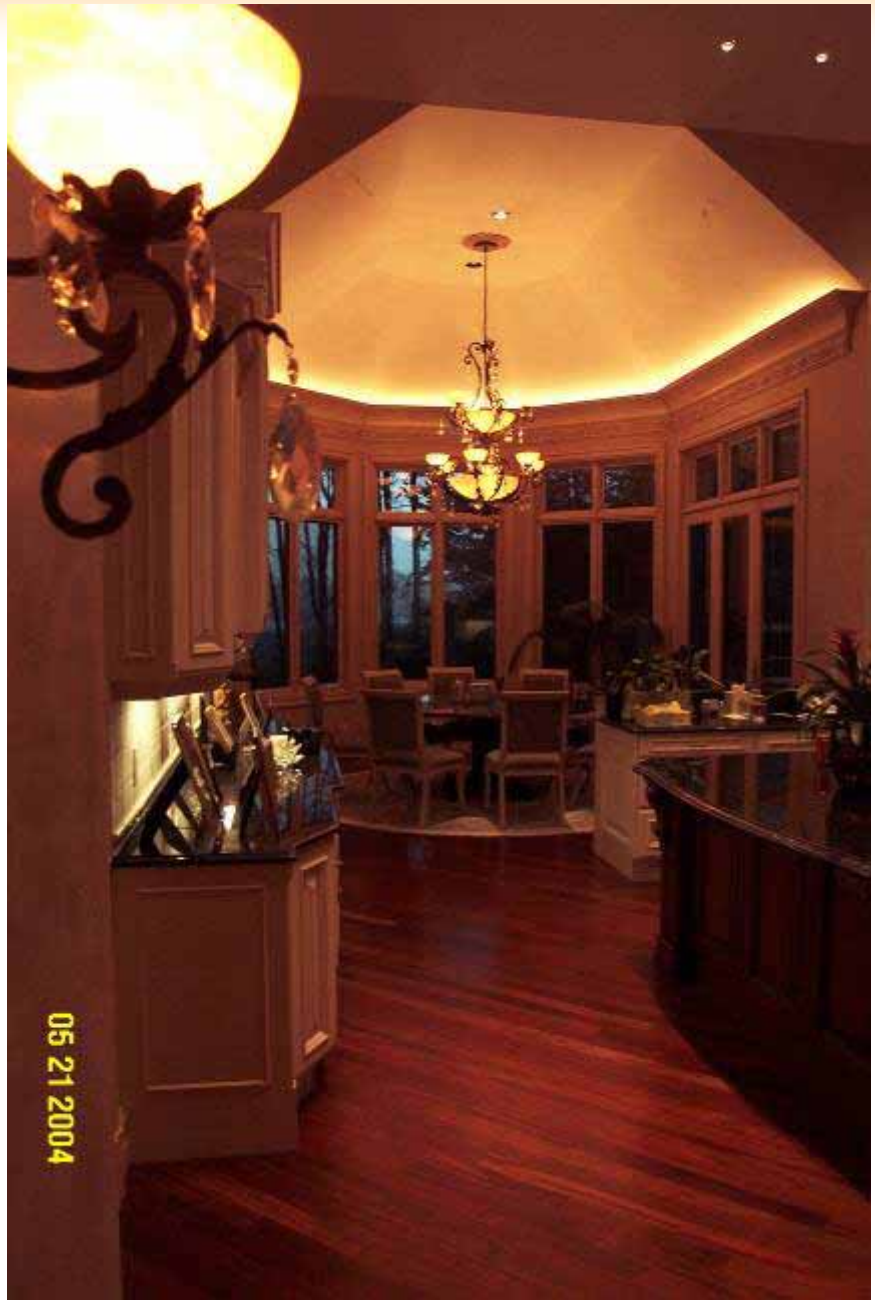
Composition

Composition

- Chandelier (ambient and decorative)
- Recessed (task)
- Recessed (focal)
- Sconce (decorative)

Composition

- Cove (ambient)
- Recessed (task)
- Undercabinet (task)
- Chandelier (decorative)
- Sconce (decorative)

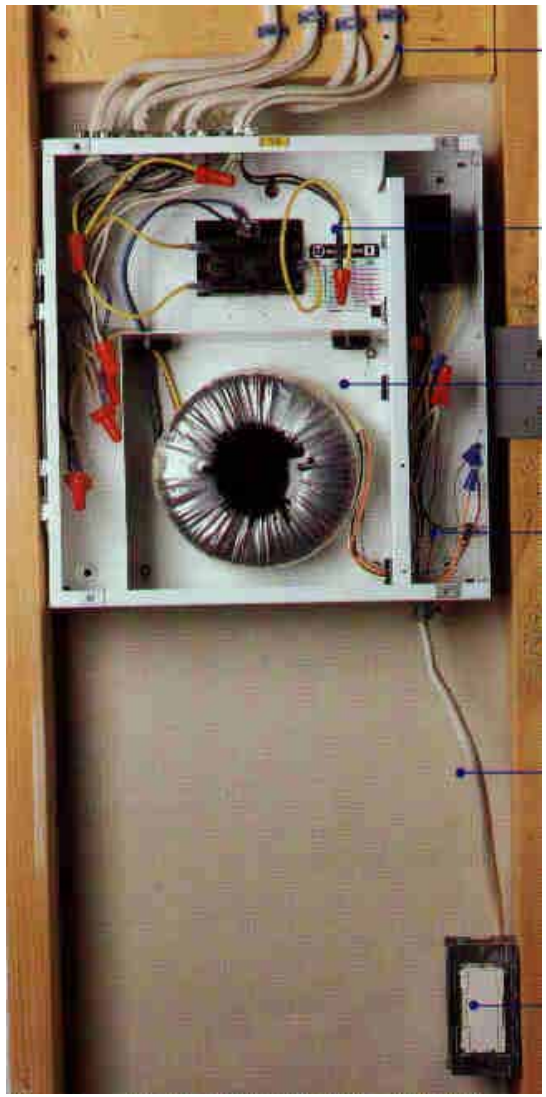


Composition and Planning for Change

- Recessed adjustable lighting
- Combined with fixed predictable lighting

Remote transformers

- Address Article 411 and 725 issues
  - Class 1
  - Class 2
- Low noise, minimum heat

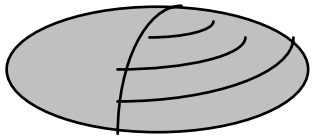


Wallwashing

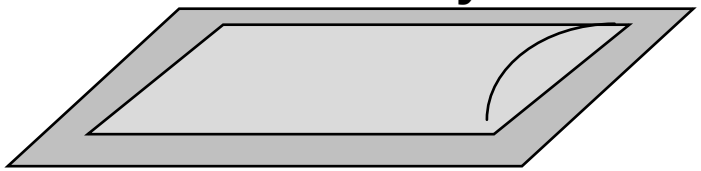
Produces a flat, even wash of light for a wall. You may find this is NOT what you wanted...

Types of Wallwashers

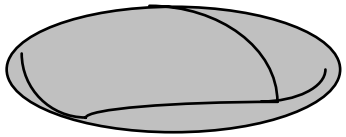
Eyelid style



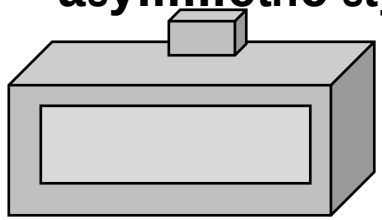
Rececssed asymmetric style

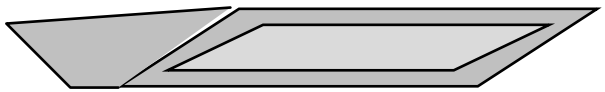


Recessed lens style



Track and surface lens and asymmetric style

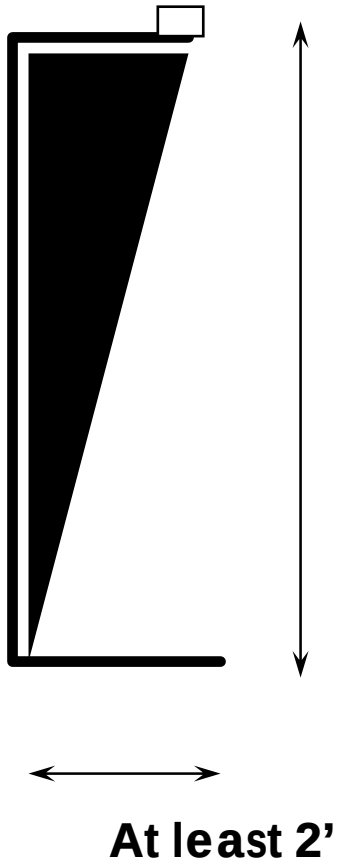




Semi-recessed lens and open asymmetric style

Principles of Wallwashing

- Fixtures at least 24” out from wall and about 1/4 wall height out from wall
- Fixtures apart 1 to 1.5 times the distance from the wall
- If you don’t need at least three - you shouldn’t be wallwashing



The higher the wall the further out to locate wallwashers

At least 2’

Undercabinet Lighting

DON'T

- Mount fixtures at back of cabinet
- Use luminous front fixtures
- Put short fixtures under long cabinets
- Put in cheap cool white or daylight lamps

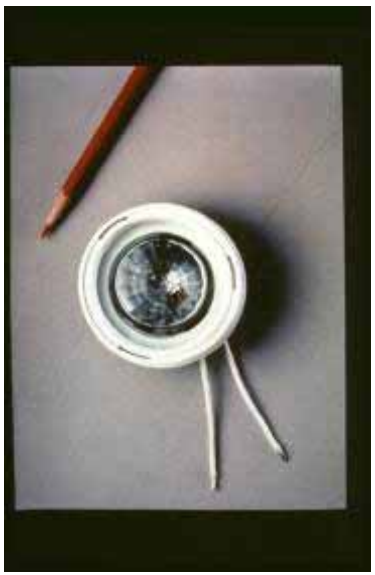
Undercabinet Lighting

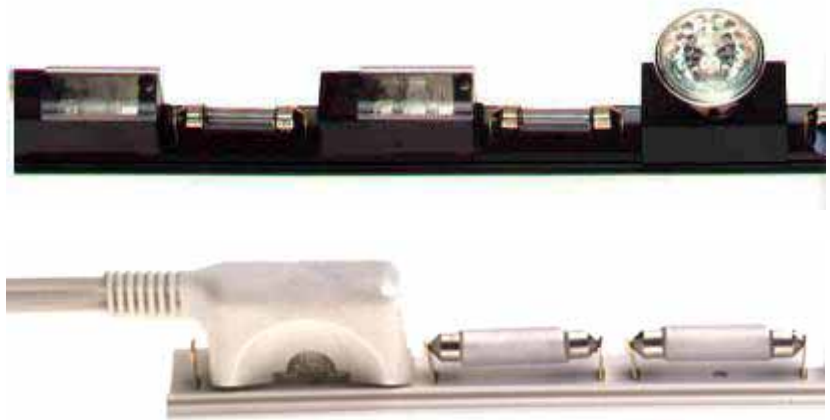
DO

- Use solid front fixtures
- Use a lens to diffuse the lamp image over polished countertops
- Choose fixtures to be as continuous as possible and wrap around corners

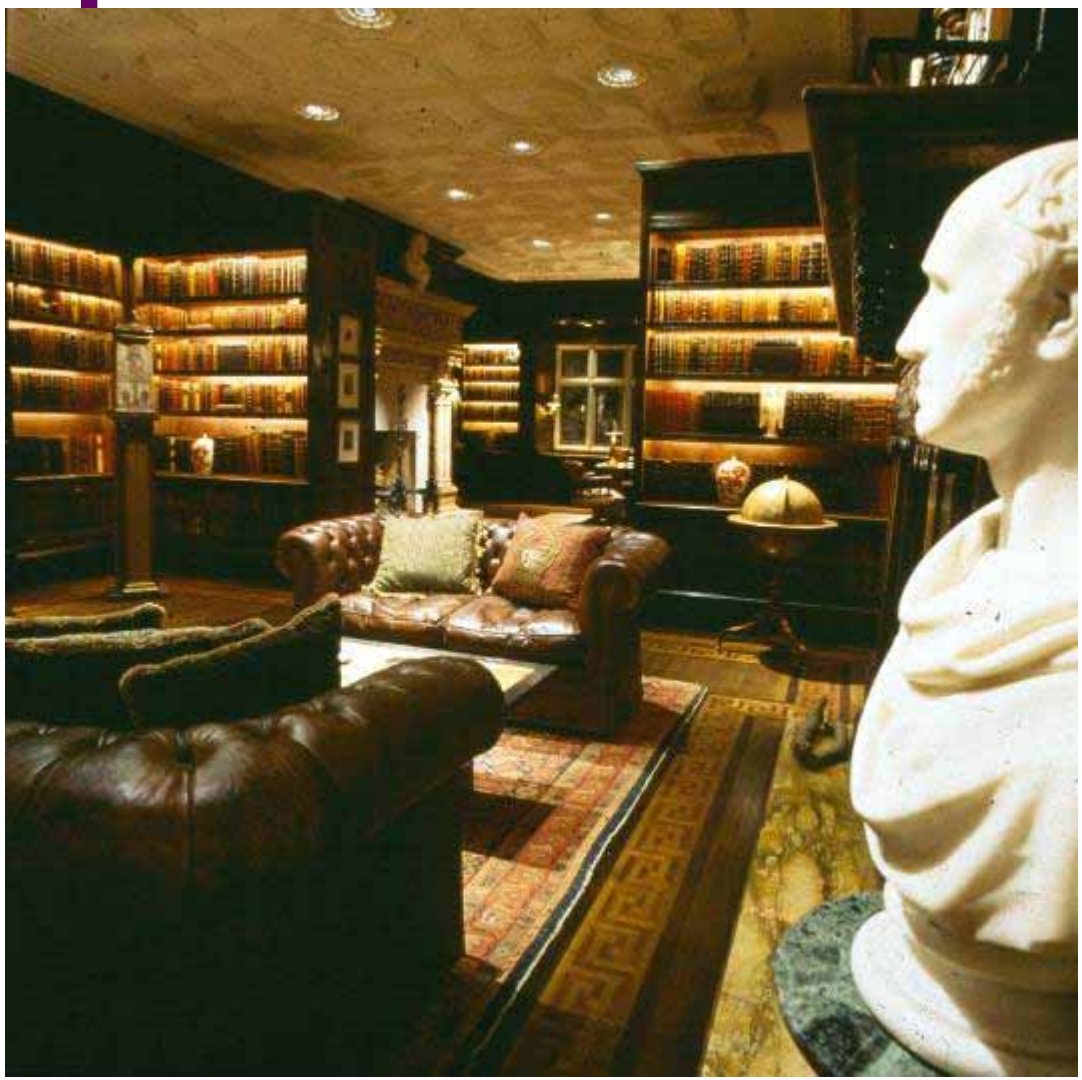
Low Voltage Specialty Lighting

- Permits finely detailed lighting effects
- Use inside and under cabinets and similar locations





Example: Bookcase



Example: Cabinet with Polished Countertop

Things to Remember: Room by Room

- Here is my basic list of lighting considerations
- I use this with every client – we expand from there

Kitchen

- **Multiple layers permits multiple moods**

Steps to Better Kitchen Lighting by Layers

Layer #1 – Light the Task

Steps to Better Kitchen Lighting by Layers

Layer #2 – Ambient Light

Steps to Better Kitchen Lighting by Layers

Layer #3 – Decorative Light

Bathroom

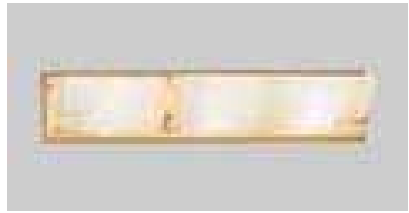
Layers

- Multiple layers for mood and flexibility

Bathroom

Layer #1-Task

Light the Face



Bathroom

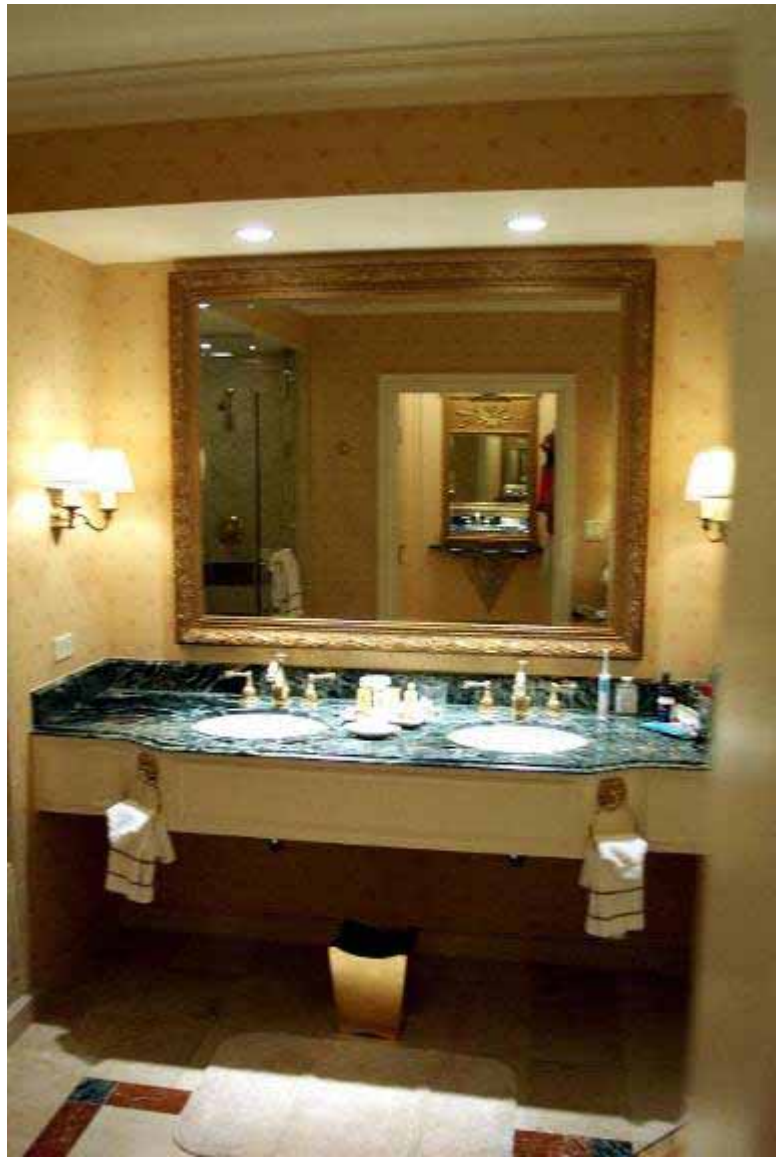
Layer #1-Task

Light the Face

Bathroom

Layer #2-Task

Light the Sink



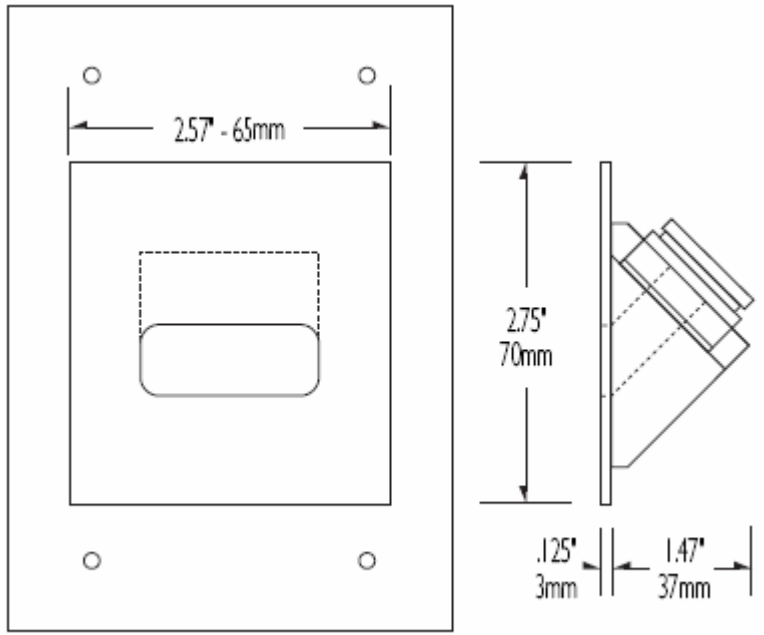
Bathroom

Layer #3-Task

Light the Shower or Tub

Bathroom

Layer #4- Night Lights



Other Lighting Things to Remember

- Dimmers and controls laid out well and kept simple
- Layers in every space even closets
- Built in night lights
- Controlled daylight
- Lens, focus and other adjustments must be done
- Good lighting extends outdoors

Lighting Design Basics

Presented by BENYA LIGHTING DESIGN

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