# Lighting Design Basics

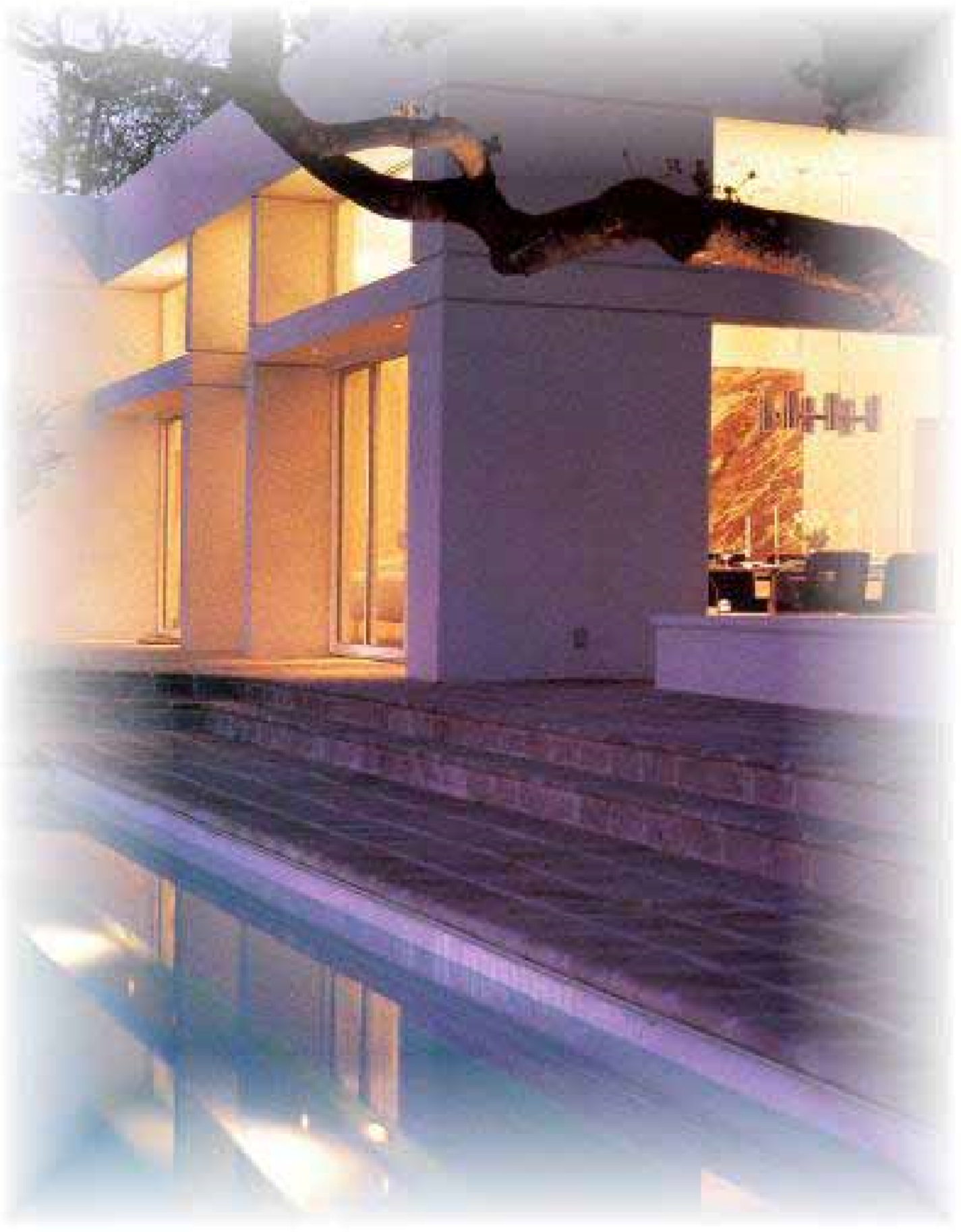
*Based on the Book by Mark*

*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**](http://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?**

1. *Residential Lighting Design*
2. *Office and Corporate Lighting Design*
3. *Hospitality Lighting Design*
4. *Health Care/Institutional Lighting Design*
5. *Lighting for Stores*
6. *Lighting Common Spaces*

**What are lighting design basics?**

1. *The Professional Process of Lighting Design*
2. *Collaborating with Lighting Designers*
3. *Computers and Lighting Design*
4. *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*

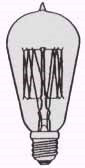
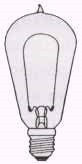
•**Appealing**

•**Warm, attractive color**

**(2600-2900K)**

•**Dimmable**

•**Wide variety**



•**Not energy efficient**

***Low Voltage Incandescent***



## *Lamps*

PAR36 Long

* **Usually low** throw display **wattage but not** lamp 2700K

**inherently energy efficient**

* **Greatest advantage: size**Low voltage



Xenon incandescent strip lights

strips and tubes 2400-

2600K

2800K

# *Halogen Lamps*



•**Appealing**

Halogen PAR 20, PAR 30

•**Crisp warm, attractive** and PAR 38 lamps **color (2800-3100K)**



•**Dimmable**

•**Wide variety**

•**Longer life, slightly**

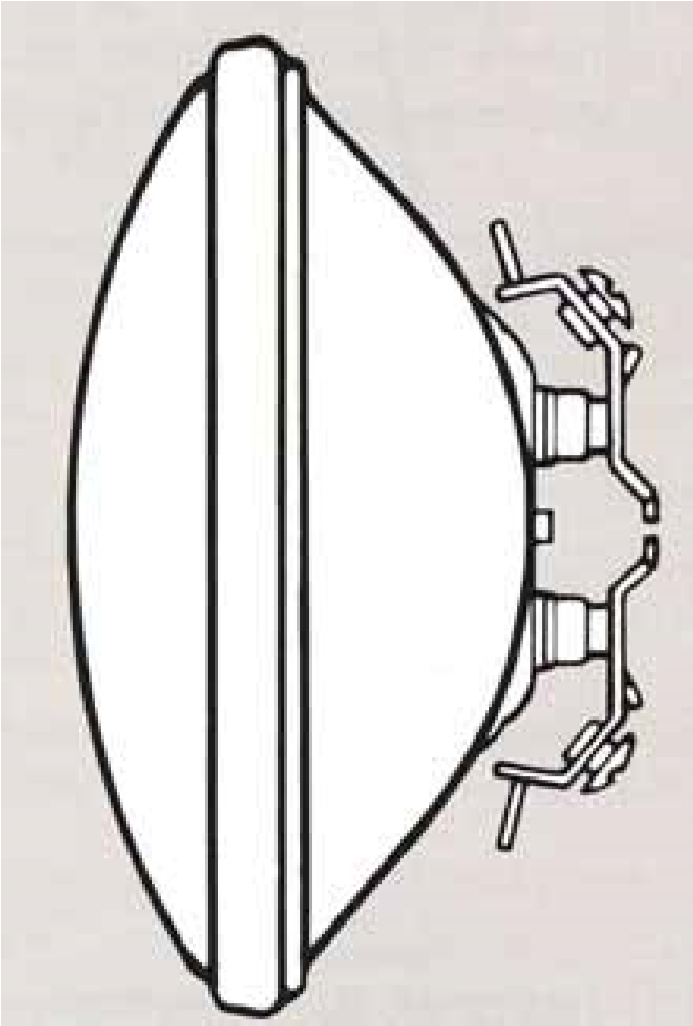
**more energy efficient** Halogen lamps for table lamps and

chandeliers

Small halogen lamps for task lights, sconces, etc.

## *Low Voltage Halogen*

* **Compact, bright lamps**
* **A bit more energy efficient**



PAR36 and

AR111

halogen

long throw

lamps

* **Excellent reading, work and display light sources**
* **Color Temp: 2900-3100K**
* **Long life**



MR16

# *Linear Fluorescent*

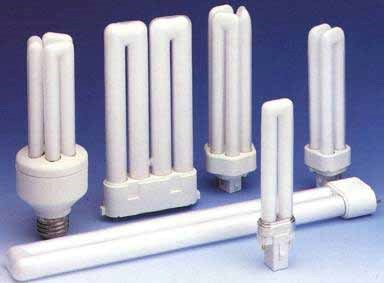
•**T-12 “fat tubes”** T-12 T-8 T-5 T-2 **no longer a good choice**



•**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

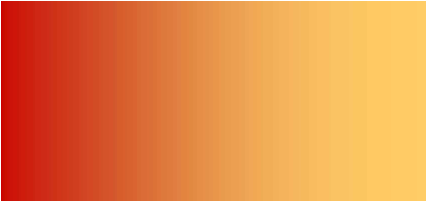
Range of

Daylight

Warm Neutral Cool Cold

1800K 2800K 3500K 5000K 7500K 10000K

2200K 3000K 4100K 6500K



9000

K

**Setting**

**Sun**

**North**

**Sky**

Range of

Fluo

rescent

Range

of

Flame

Range of

Incandescent

and Halogen

**Recommended Fluorescent**

# Lamps for Common Use

|  |  |
| --- | --- |
| **Desired Lamp Color**   * **Warm 2700K** * **Warm 3000K** * **Neutral 3500K** * **Cool 4100K** * **Cold 5000K** | **Lamp Color**  **Designation**   * **“827”** * **“830” or “930”** * **“835”** * **“841”** * **“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

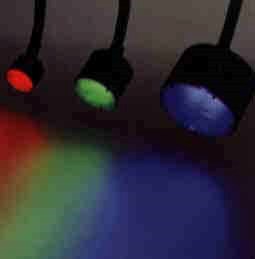
* Two wire versions now available
* Standard 3 wire and 4 wire versions also available

# 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**

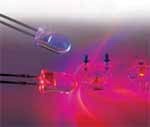
# Fiberoptics as Display Lighting

* **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

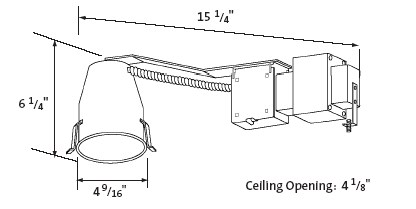


* Incandescent non-IC
* Incandescent IC
* Incandescent air tight IC
* Low voltage non-IC
* Low voltage IC
* Low voltage airtight IC • Compact fluorescent non-

## 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

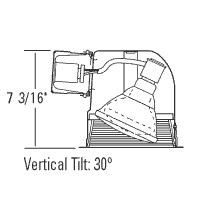
interchangeable trims

# 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**

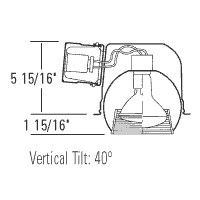
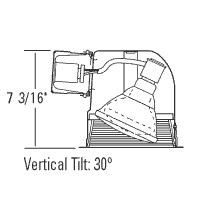
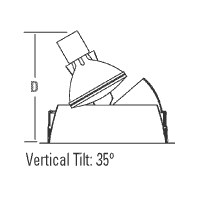
**PAR30**

* **6” family also consider the**

**PAR38**

* **Avoid so called line voltage MR16 and PAR16**

**Adjustable**



**Line Voltage**

**Recessed**

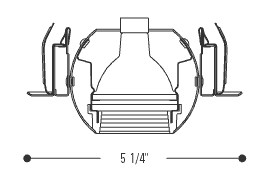
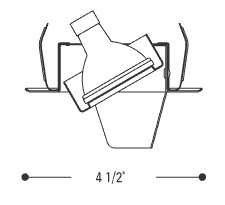
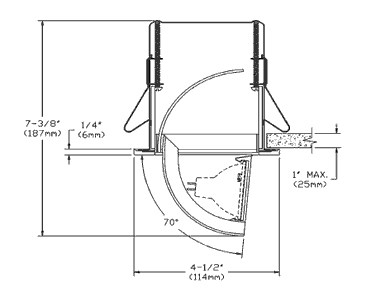
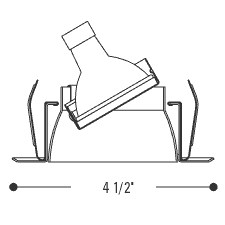
**Trims**

## 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**

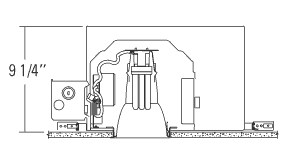
**light for tubs and shower**

**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



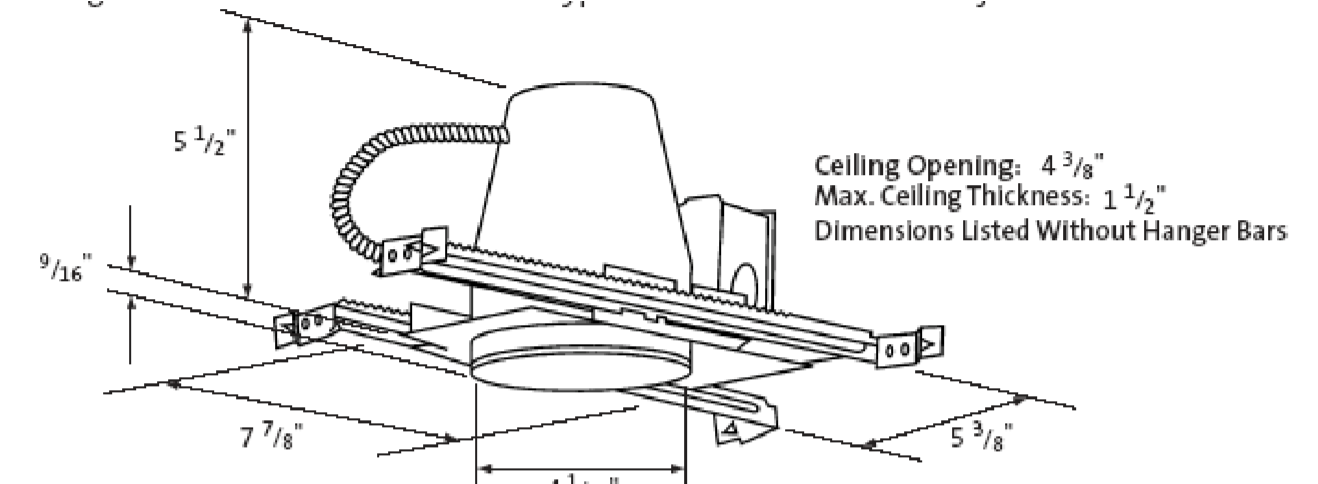
* **Standard 120 volt track**
  + **Low cost general purpose**
  + **High cost “museum grade”**
* **Low voltage track**
* **Low voltage specialty systems**
  + **Two cable systems**
  + **Two rail systems**
  + **Two conductor “bars”,**

**“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

**Artwork**

**30**

**-**

**60**

**-**

**90**

**triangle**

**Mounting Line**

**Recessed accent light**

**Track or monopoint**

***The distance from the***

***fixture to the artwork***

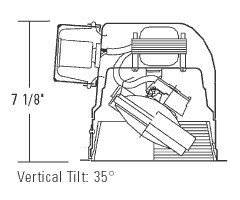
***will determine***

***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**

**Decorative**

**Focal**

**Task**

**Ambient**

# 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

**Cove lighting**

# 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

**Downlighting**

# Layer #3 - The Display or Focal Layer

* **Generally limited to accent lighting and similar effects, primarily through**

**VERTICAL AND OTHER NONHORIZONTAL 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

**Accent 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

**Chandelier**

# 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**

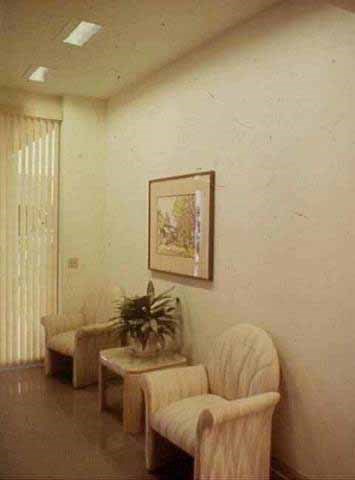
# Remote transformers

•**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

**Rececssed asymmetric style**

**Eyelid 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 The higher thewall the further**

**height out from wallout to locate**

* **Fixtures apart 1 to wallwashers**

**1.5 times the distance from the wall**

* **If you don’t need at least three - you At least 2’ shouldn’t be wallwashing**

## 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**

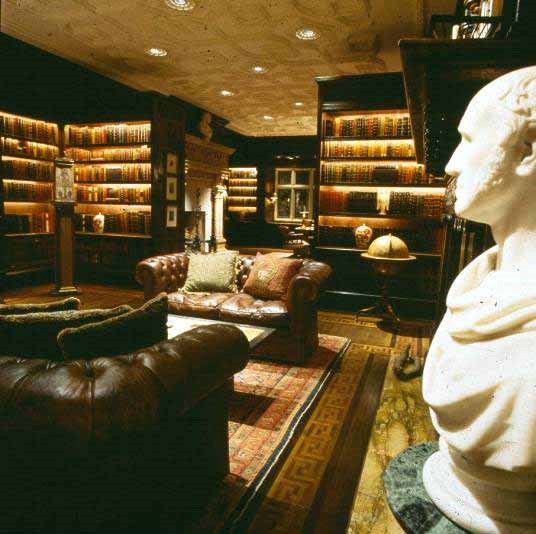
* Use solid front fixtures
* Use a lens to diffuse the lamp image over polished countertops
* Choose fixtures to be as continuous as possible and wrap around corners

# 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 –**

**L**

**ight**

**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

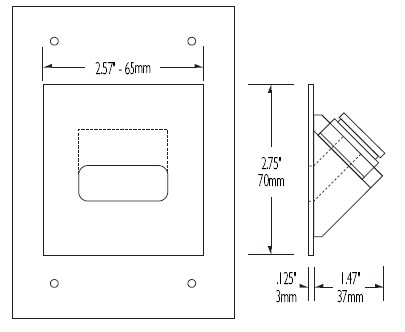
**Layer #3-Task**

*Light the*

*Shower or*

*Tub*

**Bathroom**



**Layer #4-**

**N**

**ight**

**Lights**



# Other Lighting Things to Remember

* **Dimmers and** • **Controlled controls laid out daylight well and kept** • **Lens, focus and**

**simple other**

* **Layers in every adjustments must space even be done closets** • **Good lighting**
* **Built in night lights extends outdoors**

# Lighting Design Basics

## Presented by BENYA LIGHTING DESIGN

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