Lighting & Color for Living In Place

Program Eligible for 0.1 NKBA CEUs
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Today’s Objectives

1. How Lighting & Color Affect Vision
2. Why Color is So Important
3. Benefits of LED Lighting
4. Create a Lighting Plan for Living In Place
5. Trends in Lighting
6. Steps to Success
1. How Lighting & Color Affect Vision
Eyes Change Over Time

The eye’s ability to focus changes with age.

✓ Many individuals have significant vision impairments such as cataracts, macular degeneration, diabetic retinopathy and glaucoma.

✓ The ability of the pupil muscles to fully dilate or quickly constrict degenerates.
  • Pupil Dilation – Why do so many older people use their smart phone flashlights at restaurants to read a menu? A person age 60 needs three times more illumination than a person age 20.
  • Pupil Constriction – Many older persons have difficulty with oncoming headlights or bright glares from high gloss countertops.
Medical Needs

A person with cataracts will have difficulty seeing greens, blues and violets due to the yellowing of the eye lens. They can also have blurry vision, halos around light, trouble with bright lights and seeing at night.
Medical Needs

✓ Too much and/or too little light can be a problem for a person with poor vision, but each person responds differently.

✓ Test different types and levels of light to decide what is most comfortable for your client, and then install dimmers designed for LEDs.
Medical Needs

Color Blindness – 1 in 12 men and 1 in 255 women have some degree of color blindness – Use samples for color selection but do not use color names.

Can you spot the number in the circle?

Can you spot the circle and square?
Medical Needs

 ✓ Put light directly where it is needed – for reading or other detailed tasks, use small lamps that be positioned where they can direct the light in the best manner.

 ✓ Minimize potential for glare – avoid polished counters and flooring, and recommend appropriate window coverings.
Why Better Lighting is Important?

✓ Make the general area easier to see and safer.
✓ Make the area more comfortable.
✓ Helps with task activities.
✓ Easier to find individual items, especially small ones.

Tying Fly Fishing Lures
2. Why Color Is Important
Color Temperature

Measurement of light is expressed in temperature degrees using a scale – Kelvin or K

Color Temperature in the Kelvin Scale

- Relaxing: 2,000-3,000
- Upbeat: 3,500
- Lively: 4,100
- Energetic & Productive: 6,100
- Candlelight
- Tungsten Light
- Early Sunrise
- Household Light Bulbs
- Noon Daylight Direct Sun
- Overcast Daylight
- Blue sky
Color Rendering Index

Color Rendering Index (CRI) describes how a light source makes an object appear to the human eyes. The CRI is a scale from 0% to 100% indicating how accurate a source is at rendering color in comparison to a reference light source.

✓ Light sources that have a CRI above 85% are considered excellent at natural rendering.

✓ LEDs can be “tuned” to give very high CRIs.
Light Reflectance Value (LRV) – The percentage of light a color reflects. Under 50 absorbs more light, over 50 reflects more light. Used to recommend the contrast difference between colors. The higher the difference of the LRVs, the greater the contrast.

British guidelines - Minimum of a 30 point LRV difference for adjacent surfaces and 43 point difference for walls to floor.

*General recommended minimum 20 points.*

**TIP** - LRV is usually listed on color decks and by product manufacturer.
Tunable LED Educational Benefits

Proper lighting has a tangible benefit on student learning. One study, “The Relationship of Dynamic Lighting and Oral Reading Fluency” led to the development of shifting among four light level and color temperature settings. These four settings mimic the natural patterns of daylight:

- **Normal** – Standard brightness and color – Normal lesson
- **Focus** – Highest lighting intensity and cool color tone – Concentration & testing
- **Energy** – Highest lighting intensity and very cool color tone – Alert during mornings and after lunch
- **Calm** – Standard intensity level and warm color tone – Calms an energetic class

Case Study – School in Germany

A year-long scientific experiment with 166 students and 18 teachers. Students in controlled lighting settings showed significant improvement in concentration, attention span and behavior.

- Reading speed – 35% increase
- Frequency of errors – 45% decrease
- Hyperactive behavior – 76% decrease

✓ Lighting control led to better teacher management of the students.
Summary of Lighting & Color in the Home

Color temperature (K), color rendering index (CRI) and the light reflectance values (LRV) have an effect on how individuals interact within their environment.

✓ The ability to tune the color and adjust the intensity of lighting affect learning and behavior control for individuals of all ages.

Work with a lighting specialist and, if needed, a vision specialist and/or occupational therapist to determine what you should recommend to make home environments conducive for tasks and behavior modification.
3. Benefits of LED Lighting
LED

Light Emitting Diode

is a semiconductor diode that emits visible light when an electric current passes through the circuit.

LEDs are NOT a bulb!
Life Expectancy of Different Illumination Sources

- **Incandescent**: 1,000 hours
- **Halogen**: 2,000 hours
- **Xenon**: 6,000 hours
- **Fluorescent**: 20,000 hours
- **LED**: 25,000 to 100,000 hours (2.5 to 10 years)
# Lighting Technology Comparison

<table>
<thead>
<tr>
<th></th>
<th>LED</th>
<th>Halogen</th>
<th>Fluorescent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Temperature</td>
<td>2700 - 6500 K</td>
<td>3000 K</td>
<td>2700 – 6500 K</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>0.5 to 6 Watt</td>
<td>5 to 50 Watt</td>
<td>7 to 58 Watt</td>
</tr>
<tr>
<td>Luminous Efficacy</td>
<td>30 -150 Lumen/W</td>
<td>28 Lumen/W</td>
<td>80 Lumen/W</td>
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<tr>
<td>Service Life</td>
<td>Up to 100,000 hrs</td>
<td>~ 2,000 hrs</td>
<td>~ 20,000 hrs</td>
</tr>
<tr>
<td>Heat Generation</td>
<td>~ 98° F</td>
<td>~ 240° F</td>
<td>~ 170° F</td>
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</tbody>
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12 Benefits of LED Lighting

1. LEDs usually do not create a buzzing sound like many fluorescent fixtures.

2. LEDs do not flicker. Fluorescent bulbs flicker which can cause eye strain and headaches.

3. LEDs can generate the closest spectral match to sunlight.

4. LEDs are shown to reduce headaches, dizziness and nausea caused by gaps and spikes in color from fluorescent and incandescent bulbs.
12 Benefits of LED Lighting

5. LEDs produce light in the visible spectrum with very small amount of UV and IR compared to incandescent, fluorescent, halogen bulbs.

6. Extended exposure to UV light, especially from fluorescent and halogen lights, can contribute to cataracts and age-related macular degeneration.

7. Infrared heat radiation from incandescent or halogen bulbs can make individuals uncomfortable.

8. Better control of illumination levels using LEDs minimizes straining of the eyes, especially important for seniors whose eyes let in less light and take longer to adjust to bright light levels.
12 Benefits of LED Lighting

9. Changing the color temperature and the amount of illumination throughout the day can have a variety of benefits, even for persons with Alzheimer’s disease or dementia:

✓ Reduce sleep disturbances – light controls circadian cycles
✓ Reduce agitated behaviors
✓ Reduce depression and falls
12 Benefits of LED Lighting

10. Avoiding the amount of blue light in the evening and at night, which reduces the production of the hormone melatonin, a natural sleep aid.

11. Appropriate lighting and illumination have been shown to be beneficial for recovery in hospital and rehab institutional settings.

12. Better lighting can help minimize Seasonal Affect Disorder, which causes depressive symptoms. Typically more pronounced in the winter, especially in northern latitudes.
4. Create a Lighting Plan for Living In Place
Create a Lighting Plan

For Kitchen & Bath Designers, an integral part of our work is creating a lighting plan.

✓ Some designers draw their own lighting plans, smart designers engage with lighting design experts.

✓ Consider working with a medical specialist to meet a client’s specific needs.
Create a Lighting Plan

✓ Kitchens and all other habitable rooms. Window and/or skylights minimum square footage 8% of the total room.

✓ Lighting from multiple sources and dimmable.

✓ Dark surfaces in kitchens and baths need minimum 1/3 more illumination than lighter surfaces.
Create a Lighting Plan

Is it possible to add too much light into a space?

Task lighting:

✓ Under Cabinet – Mount fixtures close to the front of the underside of upper cabinets. Be careful of placement above toaster, coffee makers, etc.

✓ Cooktops & Sinks – Either an overhead vent hood with lighting or place recessed or ceiling lights about 15”-18” apart over the cooktop.

✓ Eating Areas – Pendant centered about 30” above the table or counter at least 4 feet from the ceiling.
General Lighting:

Locate switches for easy access when entering a room or area.

✓ Switch center 44” above the floor.

✓ For some areas, recommend motion or voice-activated switches.

✓ Change all bulbs to LED – Better light options, tunable, energy efficient and long life.
There are no simple formulas, general, task, and highlight lighting all work together and require different combinations of lumens. A lighting specialist must be included on the team to make the best recommendations.
Trends In Lighting

5.
Stair Lighting

Per 2019 IRC R303.7 – Light source on treads and landings to be not less than 1 foot-candle (11 lux).

✓ Is 1 lumen truly enough illumination for an older person or someone who has vision limitations, especially to prevent a fall?

✓ Add lighting under the treads and handrails.
LED Lighted Mirrors

- Light in the mirror
- Uniform light illumination – Can be dimmed or color-tuned as necessary
- Reduces glare
- Television in the mirror!
Lighted Outlet & Switch Cover Plates

✓ Replace existing cover plates
✓ Dimmable
✓ Turns on at low light
✓ Allows both outlets to be used
Tunable LEDS

✓ Bulbs, tubes or ribbons
✓ RGB - Almost endless color options
✓ ”Multi-white” – Variable white color temperature
✓ Create different moods or energy levels
✓ Direct or remote control
✓ WIFI enabled or dedicated devices
Low Voltage LEDs

- Plugs into standard outlet
- 12V, 24V 350mA systems
- Universal power supplies 110V to 240V, 50 – 60 Hz
- After driver (transformer), wiring is low voltage
- Standardized, quick connections
LEDs
Battery Options

✓ Battery Powered
✓ USB Rechargeable
Self Adjusting Shades

Self adjust with sunlight, temperature and pre-set schedule
Tunable LCD Windows

Imagine windows that change colors or the amount of light that comes through? Is this hocus pocus?

The Boeing 787 Dreamliner airplane has LCD (Liquid Crystal Diode) windows that can be tuned for color and light transmission.
Designers Light The Future

✓ New shapes and possibilities for lighting
✓ LED
✓ Flexible OLED (Organic Light Emitting Diodes)
With the increasing use of devices such as the Amazon Alexa, Google Home and Apple Siri, all lighting may soon be voice controlled like many other products in the home.

✓ Placement of lighting into furniture and cabinetry is rapidly moving into the realm of reality.

✓ Lighting is also making appearances in products which are much more common from a mass market and/or price perspective.
Artificial Skylights & Windows
Designers Control The Future
Next 5 Years

LED components smaller, brighter and more efficient =
More lumens per watt

✓ LED bulbs in sizes to fit existing fixtures
✓ New forms and shapes
✓ Up to the designer’s creativity
Steps to Success

6.
Step 1. Change your perception - accessibility and safety is for all homes.

Step 2. Education. Education. Education.

Step 3. Create interprofessional teams to recommend safer solutions.
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All Homes Accessible, Comfortable and Safe

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