

# Glare Management in Daylit Spaces...

## Occupant Comfort & Satisfaction Determines Sustained System Performance

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# NEMA Daylight Management Council (DMC)



The Daylight Management Council is...

- a subject group of the Lighting Controls Section of the National Electrical Manufacturers Association (NEMA), and
- comprised of both NEMA members and non-members: designers, engineers, academics, and daylight controls & fenestration companies.



# NEMA Daylight Management Council (DMC)



## The NEMA DMC's Mission:

*Promote the widespread use of effective and efficient management of daylight and electric light in U.S. commercial buildings by advocating the use of methods, tools and best practices in building design, construction, commissioning, and operation.*

# NEMA Daylight Management Council (DMC)



## The NEMA DMC's Vision:

*All new and renovated commercial buildings combine management of daylighting and electric lighting to effectively, efficiently, and artfully meet occupant illumination requirements.*



# NEMA Daylight Management Council (DMC)

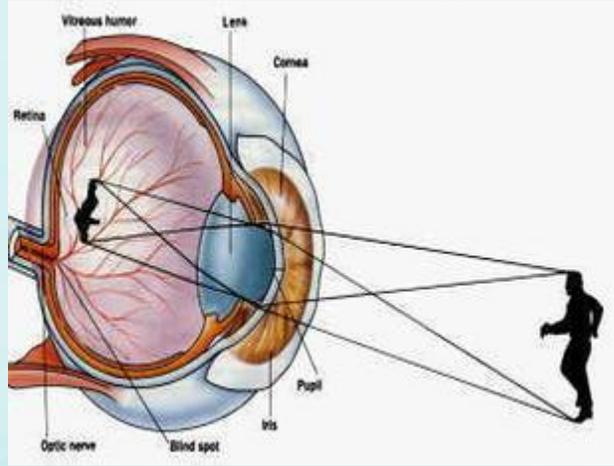


To achieve our Mission and Vision...

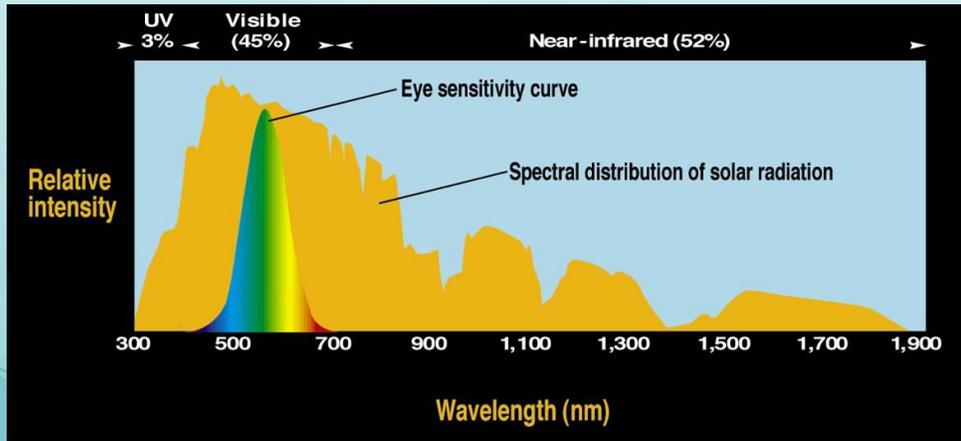
The NEMA DMC hosts regular summits focusing on discovering the barriers to quality daylight, best practices and deficiencies in design.



# The Human Visual System Drives Lighting Design!

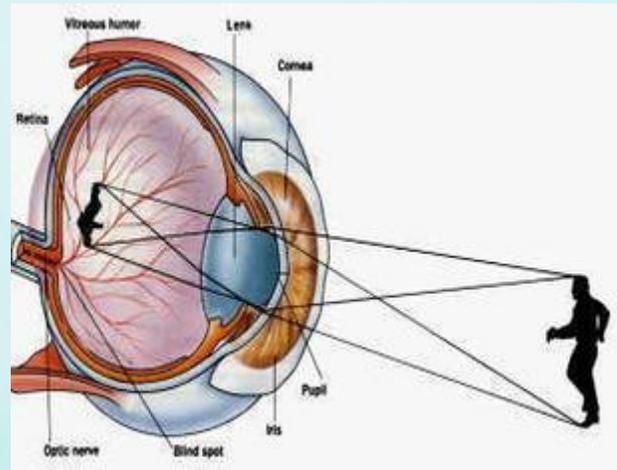


- Types of Retinal Cells in the Human Eye “react” differently to Light, allowing us to redefine the “Lumen” depending upon purpose.



- Understanding how we “see” is a fundamental element of lighting design, and helps to determine how we interact with the world around us.

# Reasons for Lighting Design!



- Vision and Task Visibility.
  - Circulation (Moving/walking/way finding)
  - Reading/writing
  - Construction/Fabrication
  - Product Selection/Shopping
  - Visual Communication



- Visual Effect & Space Perception.
  - Interaction with Architecture
  - Artful Reveal / Perception of the world around us.
  - Mood / Attention / Focus

# Lighting & Occupant Reaction



- Effective lighting design means putting light where it's wanted or needed, addressing Occupant perception, light quality/quantity, behavior of light, and space use.
- We see ***ratios*** of reflected & emitted light, not “Levels” of Light.
- Excessive luminance ratios result in visual discomfort and glare, causing occupants to “react”.
- Glare Management is key to achieving Daylighting
- Energy Savings, reducing Building Carbon Footprints, and enhancing occupant health and satisfaction!

# Daylight, Light, and Daily Light/Dark Patterns...



- Daylight is the perfect light source.
- Daylight and the daily light/dark patterns regulate our daily cycles...
  - Sleep/Wake Cycle
  - Hormone Cycles
  - When and How We Produce Key Neurotransmitters
- Necessitate Key New Terms:
  - Chrono-biology
  - Photo-biology
  - Chrono-spectral-dosage

# Daylight vs. Daylighting...



- Daylight: The Daylight Resource available from...
  - The Solar Disk (sun)
  - The Diffuse Sky Vault.
- Daylighting: The artful application of the Daylight Resource (Sky + Sun) and Architecture/products to achieve interior illumination objectives...
  - Task Illuminance for visibility, and/or
  - Illumination for Visual Effect.

# Daylight is Dynamic!



Today's daylighting solutions are dynamic...

- Modern Daylighting Technologies and Solutions are “Smart”!
- Dynamic, optically-selective fenestration systems are becoming the standard.
- Occupant “activity”, driven by comfort and satisfaction, determines annual building system performance.

# Today's Daylighting Systems are Dynamic...



June 21st:  
Due to the high angle of the sun during this time of year, a limited amount of daylight enters the classroom. The only sunlight entering the room is from the upper bank of daylighting windows, no sunlight hitting the floor is resulting from the lower bank of view windows. This is of little consequence, as the classroom will most likely not be used during the summer months.



March 21st and September 21st:  
During the equinoxes, the space is better lit by daylight than during the summer solstice. While the back corners of the classroom (the north wall) are still quite dark, the side walls (the east and west walls) are fairly well lit during the day. Sunlight infiltrates the immediate third of the classroom next to the window bank, through both the view windows and the daylight windows.



December 21st:  
Due to the low angle of the sun, the space receives the most daylight during the winter solstice. While relatively dark at the morning reading, the later readings reveal a classroom that is well illuminated. As you can see from the images, the west wall seems to glow. During this date, the sunlight seems to be at its most dynamic level of the year, hitting not only the floor, but also the east and west walls of the classroom. The sunlight infiltrates much more of the classroom, which could be problematic for occupants.

Yesterday's Single Point-in-Time and/or Single Test Condition metrics do not tell the performance story for dynamic fenestration technologies *OR* occupant comfort & satisfaction.

## Today's Daylighting Analyses & Solutions are Dynamic!

- Dynamic Fenestration Ratings and Performance Data
  - ✓  $VT_{\text{annual}}$  – Annual Visible Transmittance
  - ✓ Dynamic Photometry
  - ✓ Dynamic SHGC Performance Ratings
  - ✓ System Bidirectional Scattering Distribution Function (BSDF) Performance Data
- Dynamic Space/Building Ratings & Metrics are here (*IES LM-83-12 Adopted by USGBC's LEED 4*)!
  - ✓ sDA – Spatial Daylight Autonomy
  - ✓ ASE – Annual Sunlight Exposure

# The Big Picture of Persistent, Sustainable Design

To be successful, the building design team ***must*** rely on a creative use of complimentary systems and design techniques that work to address the occupants' needs and expectations.

# 2019 Daylighting Symposium – Glare Management

*It's all about the Occupant, pure and simple!*



Today..

- We will explore solutions that address the potential for mitigating glare through the design, evaluation, application, and operation of manual, passive, or automated daylighting management systems.
- We will brainstorm how design, analysis, construction, and operation practices can be improved through new innovations, equipment, and solutions.



# 2019 Daylighting Symposium – Glare Management

*It's all about the Occupant, pure and simple!*

Presentations

Technology and Application Case Studies

Brainstorming Work Sessions



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## Presentations

- State of Daylighting in California – The Statewide CASE Team
- Valuing Daylight and View – Lisa Heschong
- What's on the Horizon and What's Sunsetting? – Kevin Van Den Wymelenberg, *University of Oregon*

Technology and Application Case Studies

Brainstorming Work Sessions



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## Presentations

### Technology and Application Case Studies

- Controls, Glazing, Shades, and Automation Technologies: Occupant Comfort and Satisfaction Lessons Learned from the LBNL Testbed Lab and IEA Research Projects – Eleanor Lee, *LBNL*
- Dynamic Light-Redirecting Technology: One Look into the Future – Luís Fernandes, *LBNL*
- Modeling and Predicting the Performance of Automated Glare Management Systems: The Reality of Informing the Design Process – Daniel Glaser, *LightStanza*
- Lessons Learned from Two Acclaimed Daylit Buildings – Daniel Huard, *Global Green Tag Americas LLC*
- Bringing State-of-the Art Automated Glare Management Solutions to Life: Santa Ana City Hall - John Crowley, *Rollease Acmeda*

## Brainstorming Work Sessions



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*It's all about the Occupant, pure and simple!*

Presentations

Technology and Application Case Studies

**Brainstorming Work Sessions**

- Codes and Standards
- Daylight Management Research Prioritization – Refining the Design, Application, and Use Process



# 2019 Daylighting Symposium – Glare Management

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## Today's Outcome...

- Detailed project Case Studies
- Improved Industry Best-Practices, and
- New Energy Codes & Standards Opportunities & Proposals

Let's get started!