

NGA GLASS CONFERENCE™ MIRAMAR BEACH

JANUARY 24-26, 2023

NGA
NATIONAL GLASS ASSOCIATION with GANA

Physiological Impacts of Light on Human Health & the Implications of Glazing



PHYSIOLOGICAL IMPACTS OF LIGHT ON HUMAN HEALTH & THE IMPLICATIONS OF GLAZING

Glazing Implications:

- For eye health, include peak at 380 nm and everything longer. Block shorter wavelengths below 380 nm.
- Choose double silver with exterior shading.
- Choose low iron over clear.
- Add solarium rooms for light exposure rather than whole building.
- Most important applications are child development: school & daycare, residential.

- Research on tree shrew confirming violet light is critical to retinal development and avoiding myopia.
- Lighting industry convinced architects electric lighting is a solution for circadian rhythm. Within the next 18-24 months we will have data showing we need both daylight and artificial light.



PHYSIOLOGICAL IMPACTS OF LIGHT ON HUMAN HEALTH & THE IMPLICATIONS OF GLAZING

Research Update, Richard Lang

- We now have pretty good evidence that violet wavelengths 360-400 nm are crucial for giving the eye its normal shape, and this occurs through Opsin 5.
- In a mouse model, there is evidence that we can suppress myopia with violet light. Tree shrew research agrees with mouse research findings, so this pathway does apply to humans, as tree shrew is nearly a primate.

PHYSIOLOGICAL IMPACTS OF LIGHT ON HUMAN HEALTH & THE IMPLICATIONS OF GLAZING

Known Facts – Lisa Heschong

- Low iron glass is a preferred substrate for violet light for the 380 nm wavelength target.
- For myopia, double silver is better than triple silver and single silver or hard coat is better than double silver.

PHYSIOLOGICAL IMPACTS OF LIGHT ON HUMAN HEALTH & THE IMPLICATIONS OF GLAZING

Technical and marketing challenges for a more 'biologically-aware' glazing product

- More education is needed for architects and designers. Highlight benefits of glazing to human eyesight, for example the inflow of natural daylight into buildings. Educate architects that product A restricts light flow by 50% vs product B reduces light by 5% while meeting other design criteria.
- Developing new coatings could be a multi-million dollar effort, so look first to existing products.

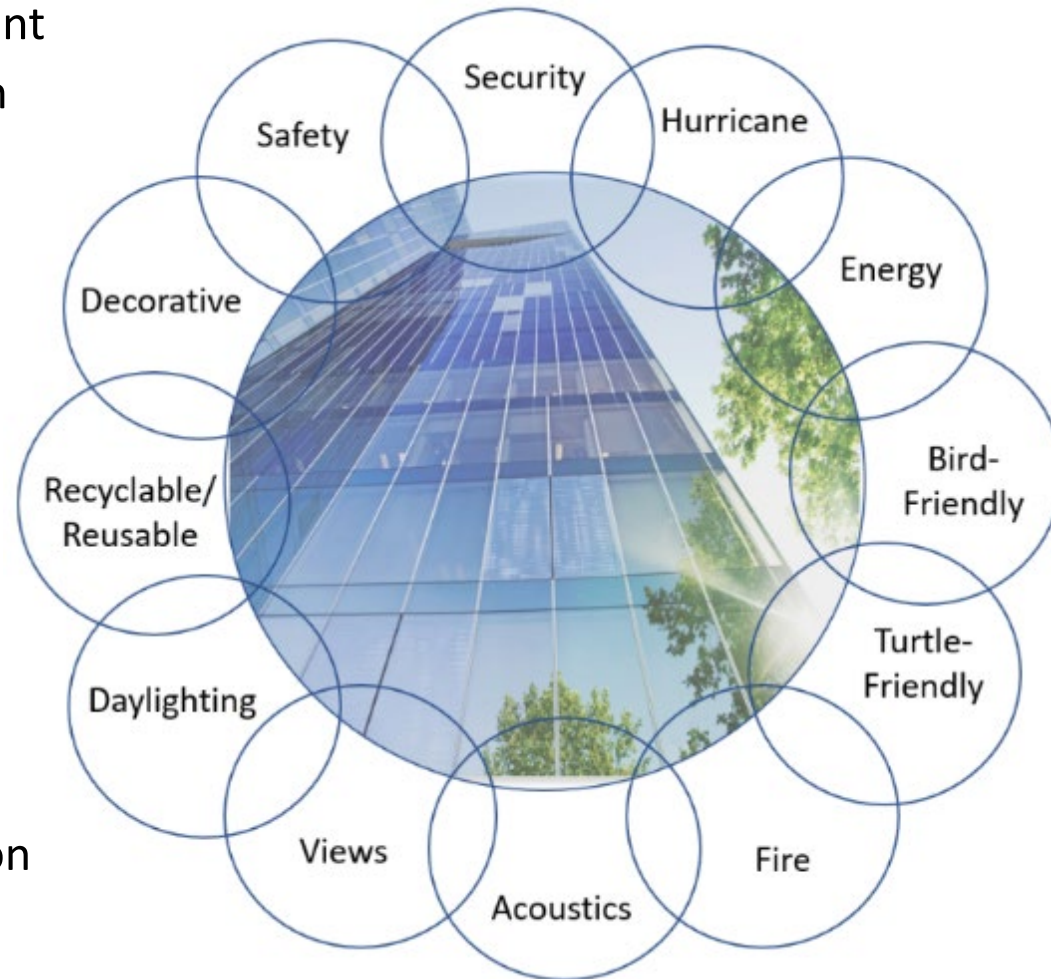
PHYSIOLOGICAL IMPACTS OF LIGHT ON HUMAN HEALTH & THE IMPLICATIONS OF GLAZING

Technical and marketing challenges for a more 'biologically-aware' glazing product

- Need to balance energy requirements, bird-friendly, myopia, etc.
- If market conditions change where there is a higher priority on human eye health than on energy policy, what would that look like?

BALANCING THE MANY FUNCTIONS OF WINDOWS

- Controlled Environment
- Weather protection
- Ventilation
- View
- Daylighting
- Fade resistance
- Energy efficiency
- Thermal comfort
- Solar gain
- Acoustics
- Privacy
- Safety
- Structural protection
- Security
- Fire
- Egress



- Many Types
- Clear, low-iron, tint
- Low-e
- Heat treated
- Laminated
- Insulated
- Vacuum Insulated Glazing
- Thin glass
- Electrochromic, thermochromic
- Photovoltaic
- Decorative
- Patterned, fritted, etched
- Applied films

And now, equally important: Physiological Impacts / Human Health

PHYSIOLOGICAL IMPACTS OF LIGHT ON HUMAN HEALTH & THE IMPLICATIONS OF GLAZING

Next Steps

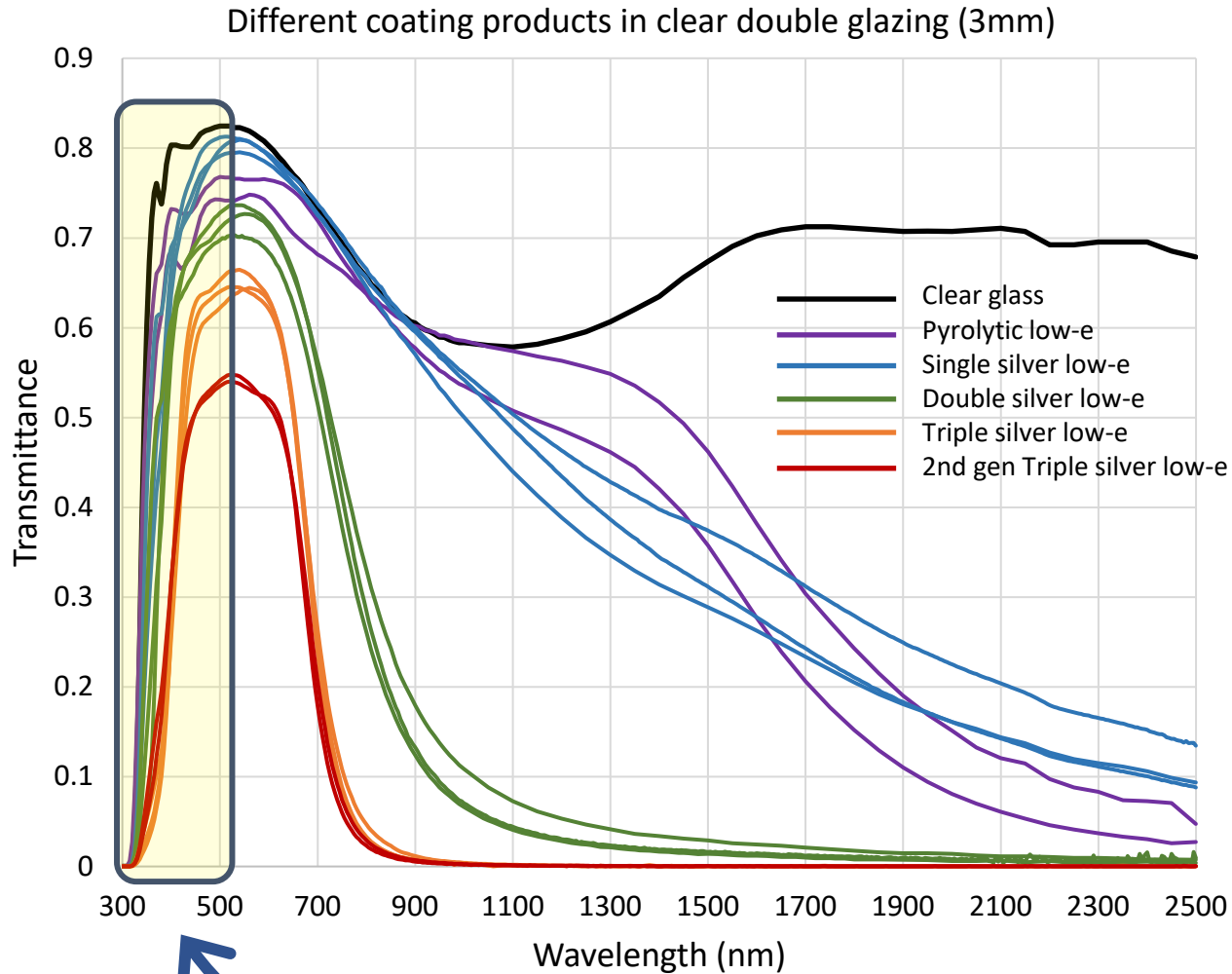
- Test cases for violet-transmitting glass
- Richard and Lisa are now funded to write a more extensive literature review in 2023, in preparation for a peer-reviewed paper on myopia and building design. Lisa will be leading the discussion of glazing and building technology.

PHYSIOLOGICAL IMPACTS OF LIGHT ON HUMAN HEALTH & THE IMPLICATIONS OF GLAZING

NGA Task Group

- Call for additional volunteers
- NGA members to provide example projects using low iron, specifically in pre-school and K-12 schools

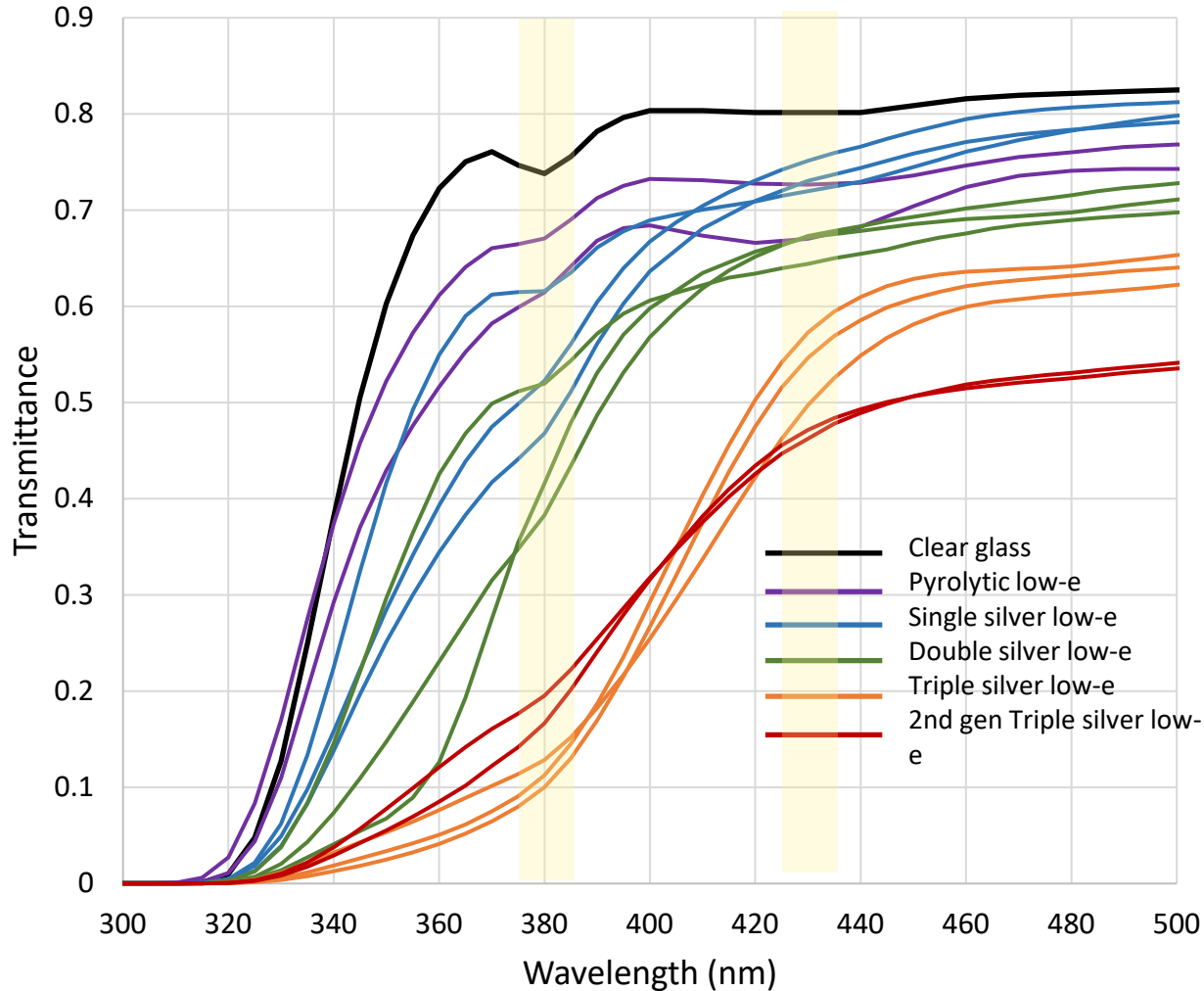
LOW-E GLASS TYPES



- Comparing spectral properties of different low-e products.
- Double glazing with 3 mm glass
- Source: LBNL International Glazing Database (IGDB)
- This is the region of interest

LOW-E GLASS TYPES

Different coating products in clear double glazing (3mm)

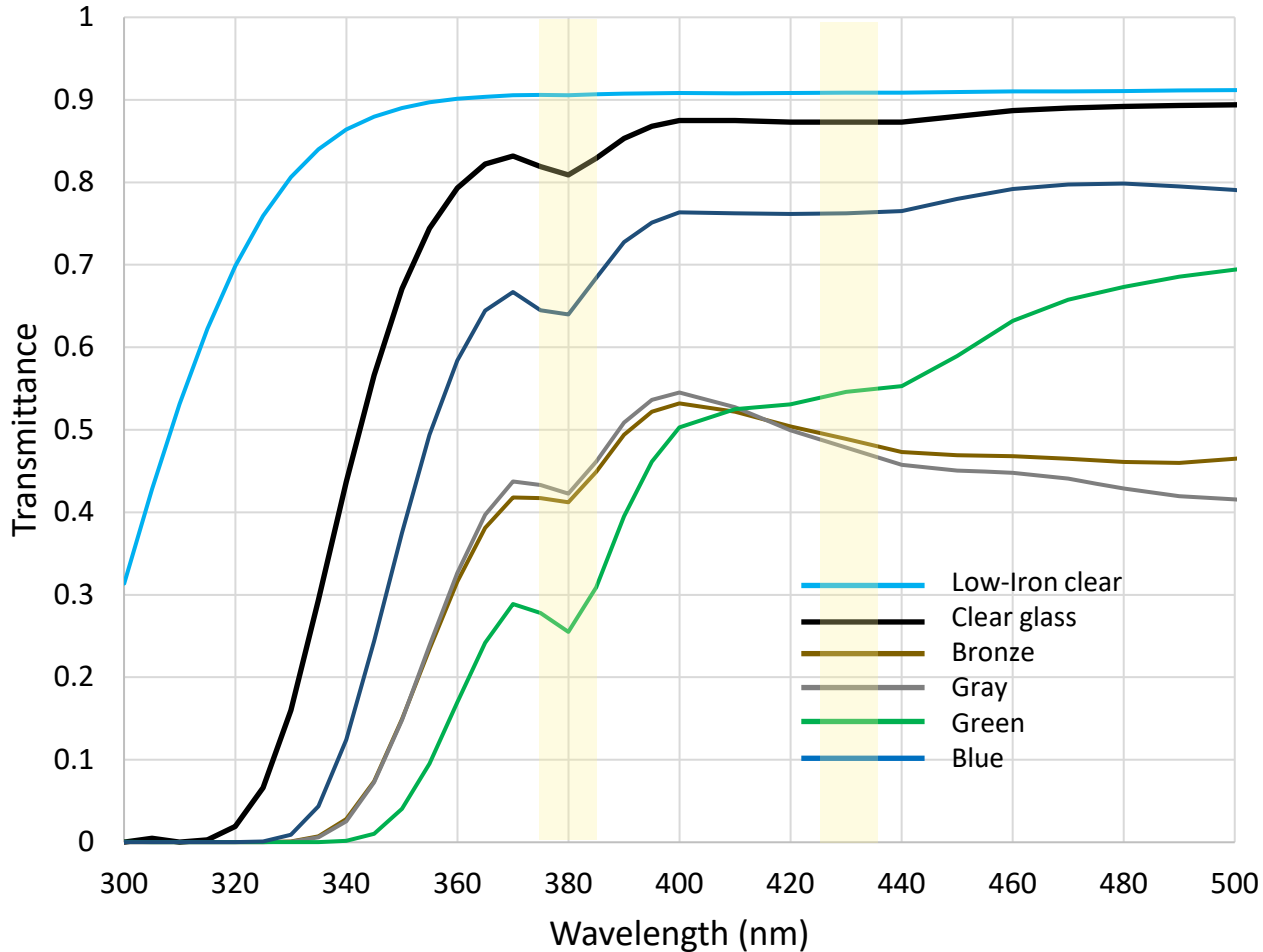


	380 nm	430 nm
Clear	74%	80%
Pyrolytic low-e	61-67%	67-73%
Single silver low-e	47-62%	72-75%
Double silver low-e	38-52%	64-67%
Triple silver low-e	10-13%	50-57%
2 nd gen triple silver low-e	17-20%	46-47%

- Clear > Pyrolytic > Single Silver > Double Silver > Triple Silver
- Lower transmittance and more variability at 380 nm than 430 nm

CLEAR VS. TINTS (MONOLITHIC 6 MM)

Monolithic glazing - clear and tints (6mm)



	380 nm	430 nm
Low Iron	91%	91%
Clear	81%	87%
Tints	26-64%	48-76%

- Low Iron > Clear > Tints
- Depends on specific tint product