

LED Track IV – Lighting Science

# Discomfort Glare

# We have all experienced it!

- On the roadway
- In the neighborhood
- At the ballpark

# Why have we had such a difficult time quantifying Discomfort Glare?

- Source Size
- Position
- Eye Adaptation
- Contrast Ratio
  - Source Luminance
  - Background Luminance
- Aging Eye

# Subjectivity!!

The subjective nature of the issue has made it difficult to quantitatively express Discomfort Glare.

# DeBoer Scale

- Observers make a conscious choice
- The chosen value has to be compared to something.
- A 4 to one person may be a 7 to another.
- Calculating the value based on the scene.

# Objectivity!!

Can we take the thought process out of the equation and just let physiological responses determine if we are experiencing Discomfort Glare?

# Physiological Methods

- Pupilometry
- Electromyography
- Facial Feature Tracking

# Pupillometry



Randy Kardon, MD/PhD, 2018, UIHC and VA Hospital, FaceX

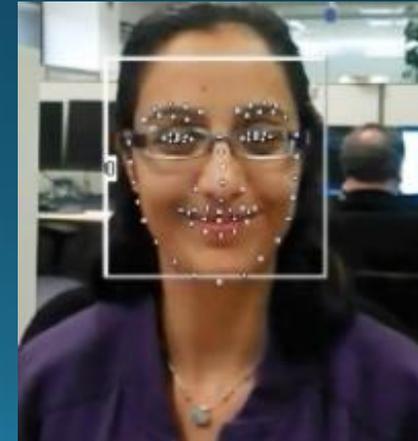
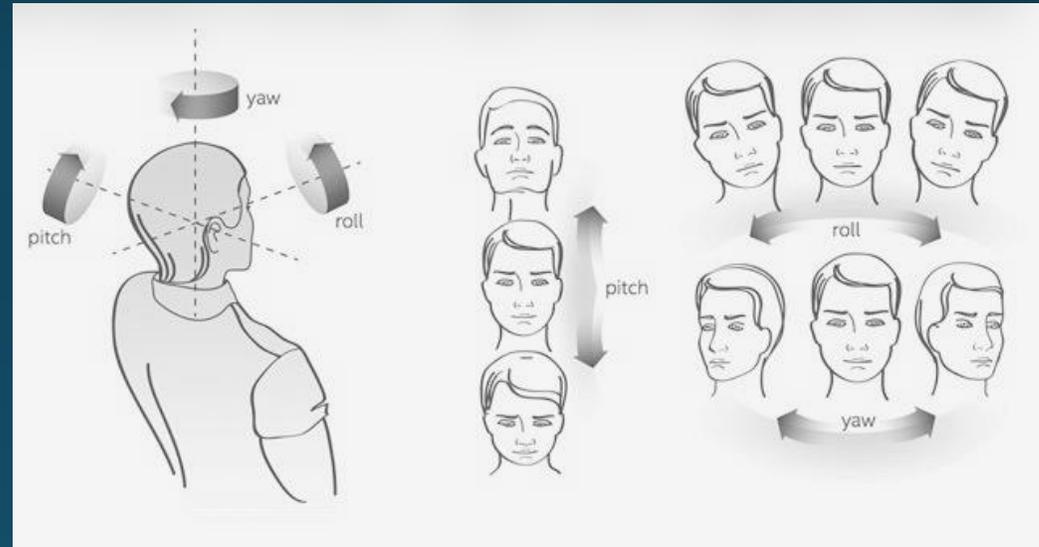
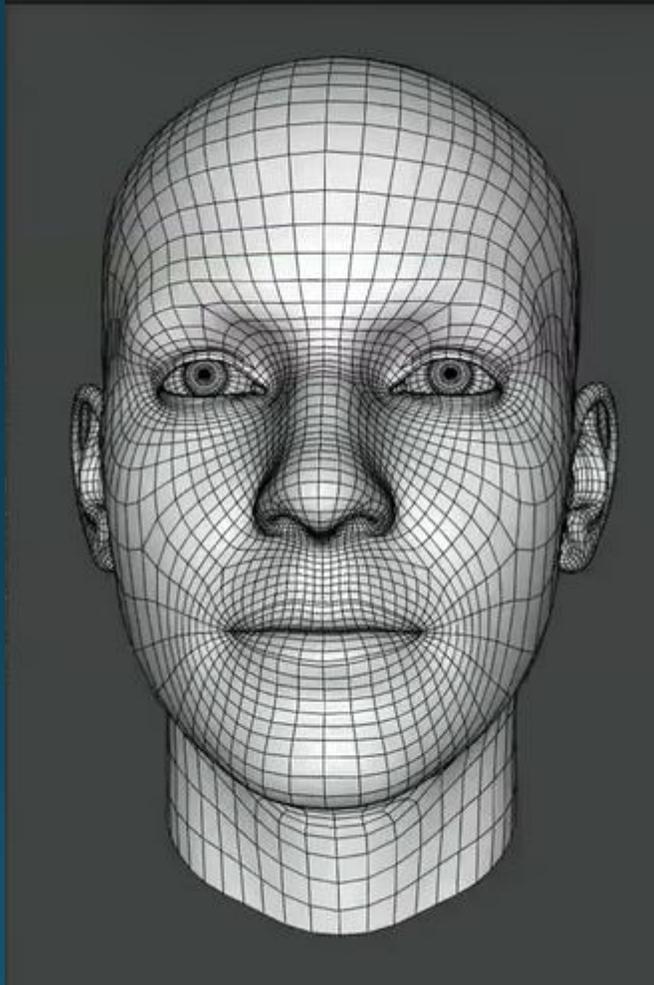
# Electromyography

- Orbicularis Oculi
- Senses electrical pulses
- Intensity of the pulses determines varying levels of Discomfort

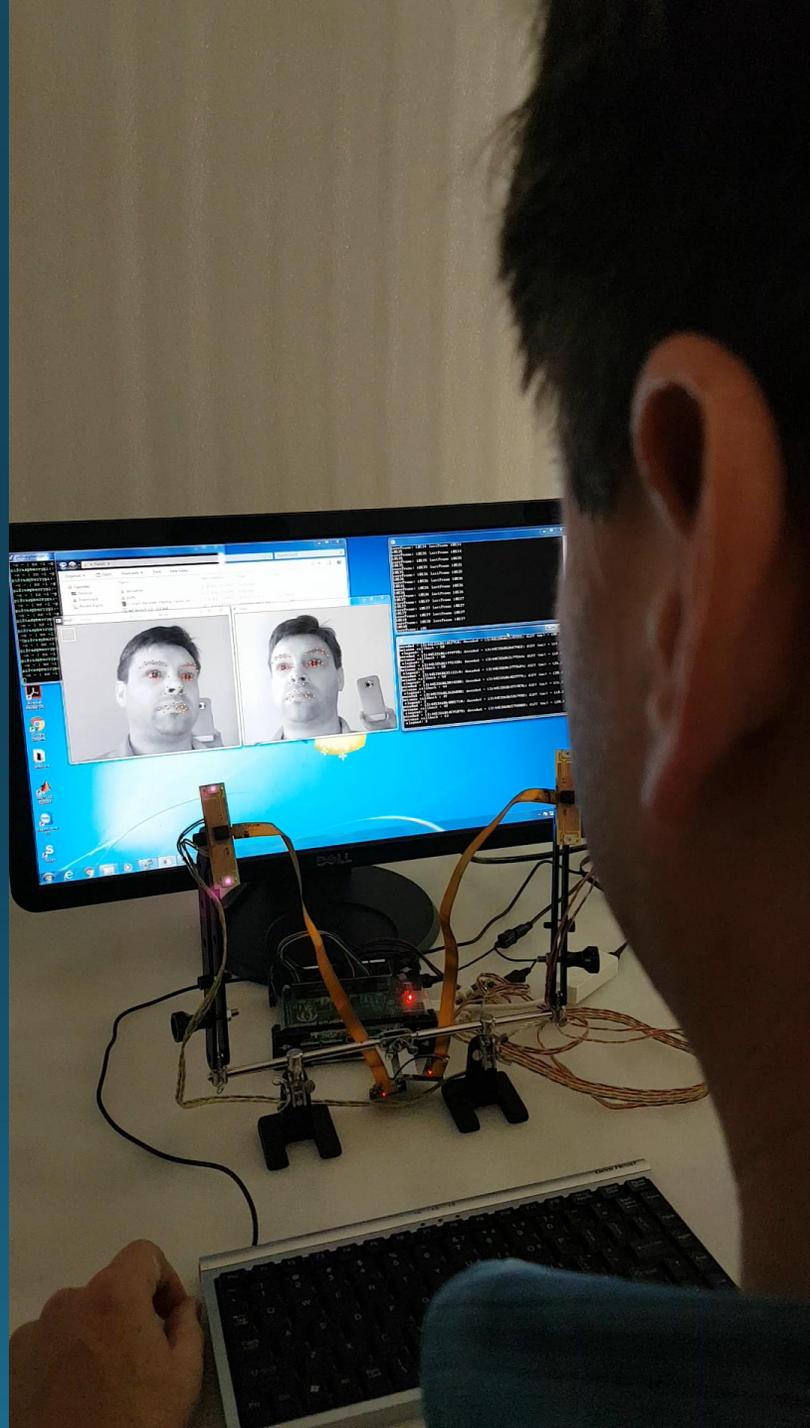
# Facial Feature Tracking

- Neuro-Ophthalmology – University of Iowa
- 3D scan of the face
- Target Points of Reference

# Facial Feature Tracking



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# Quantifying

- BGI (British Glare Index)
- DGI (Discomfort Glare Index)
- UGR (Unified Glare Rating)
- CGI (Cornell Glare Index)
- PGSV (Predicted Glare Sensation Vote)
- SR (Subjective Rating)

# Evaluation

# CIE Reports

- CIE 112 -1994
- CIE 117-1995
- CIE 147-2002
- CIE 150-2003
- AS4282-1997

# MLO – BUG System

- Glare is evaluated based on zonal lumens
- Relies solely on luminaire photometry
- Eye adaptation/zonal lumen correlation
- Not scientifically founded
- Simple method for evaluation

# IES Committee

## Discomfort Glare in Outdoor Nighttime Environments (DGONE)

# What is still needed?

- Reconciling NEW objective correlates
- Consensus on the BEST quantitative metric
- Field verification methods
- **JUST GETTING SOMETHING ESTABLISHED!**  
– something that we can all live by until future discoveries refine the metric.

# Discomfort Glare

Thank you/Questions