

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

- Pupillometry
- Electromyography
- Facial Feature Tracking

Pupilometry



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

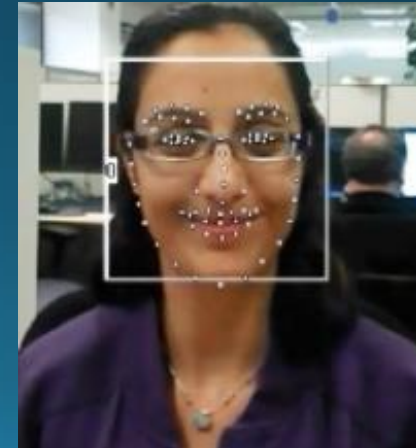
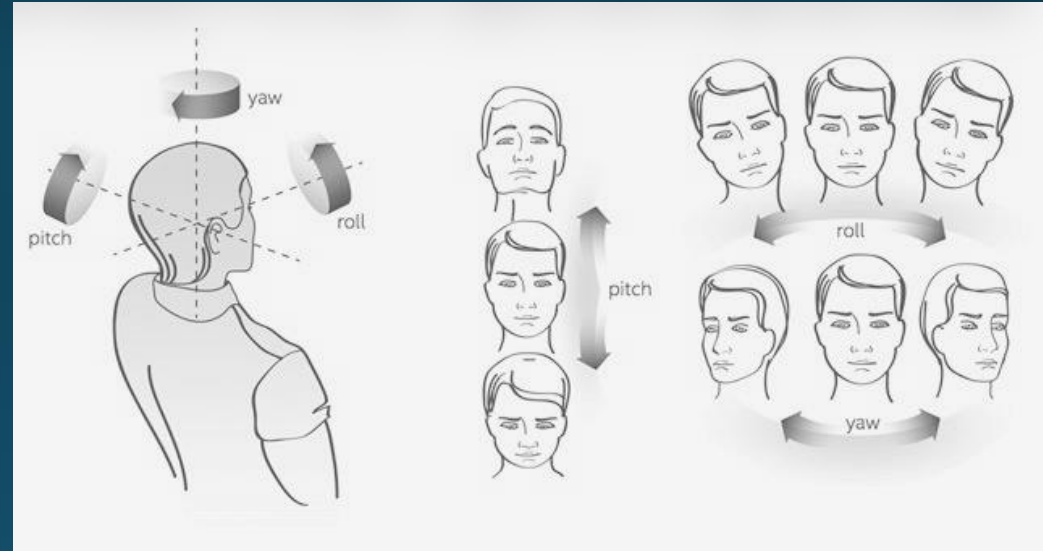
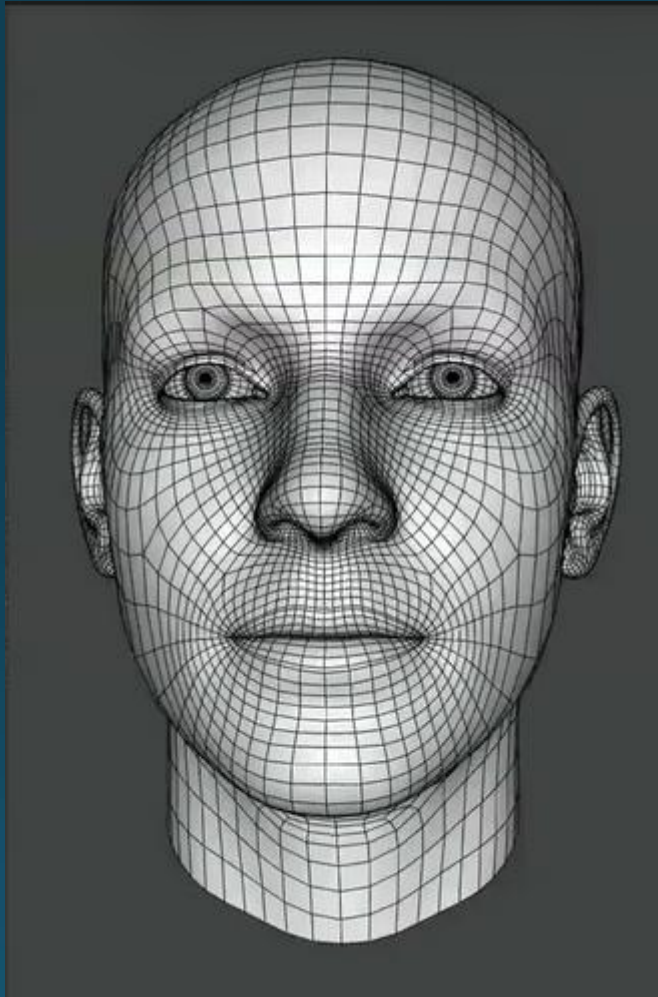
Electromyography

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

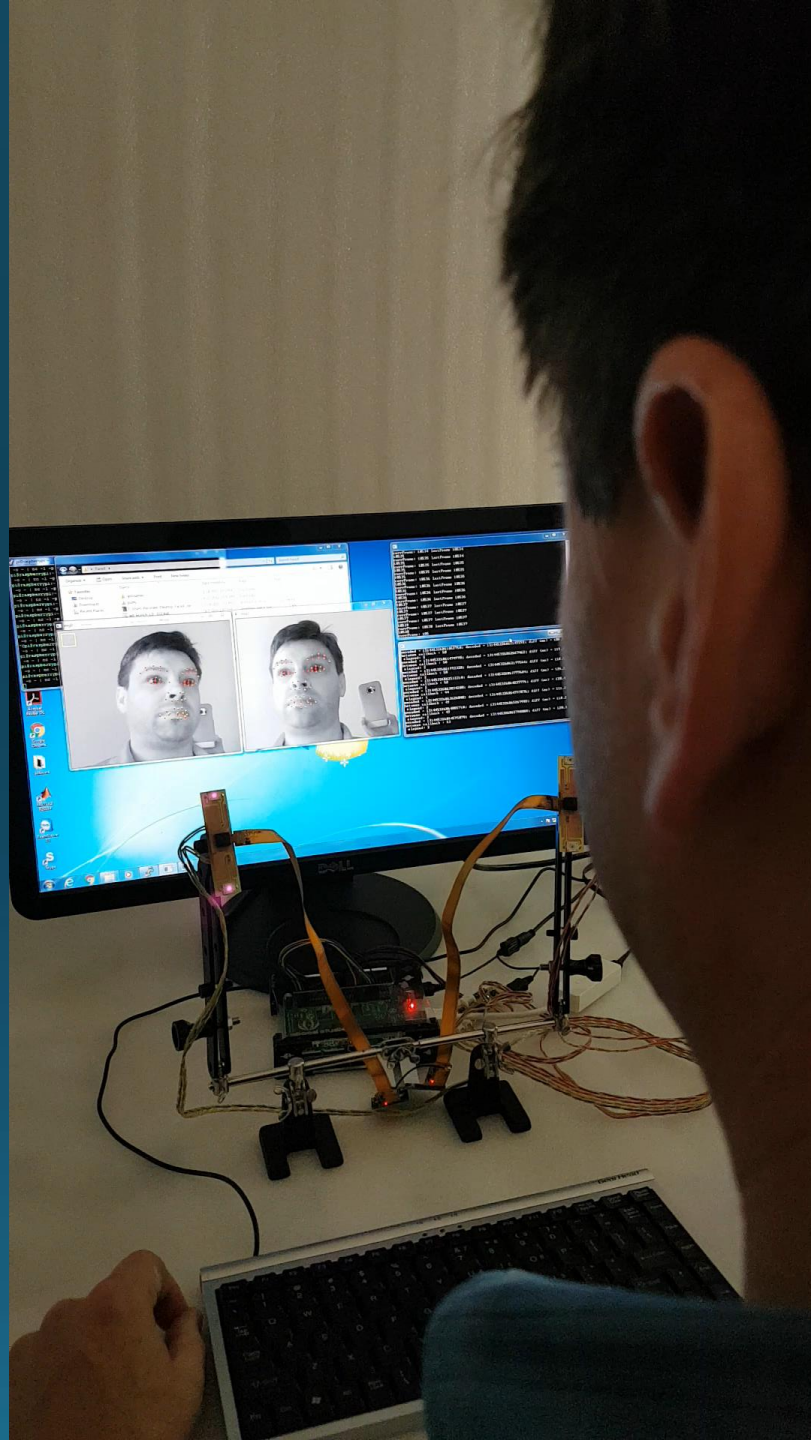
Facial Feature Tracking

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

Facial Feature Tracking



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



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