

**DISRUPTION IN
LIGHTING**



Rodney Heller LC, CLEP

- Lighting Certified, NCQLP
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- IES –Member Visual Efficiency Committee TM24
- Midwest Lighting Institute -Founder



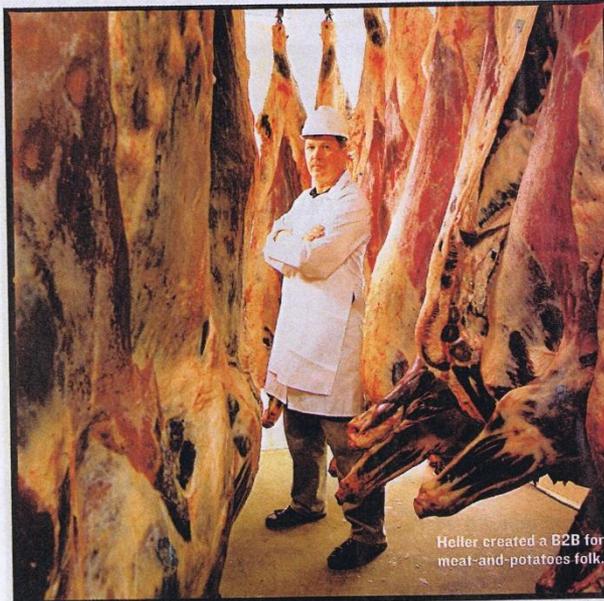
This Presentation

- PLEASE do not hesitate to ask questions
- Do not hesitate to disagree with me
- Interaction is good; it helps push us all forward!



Slaughterhouse Blues

How do you bring a bunch of meat and poultry packers into the New Economy? Very slowly.



Heller created a B2B for meat-and-potatoes folk.

BY MATTHEW SCHIFRIN

IN TERMS OF DIGITAL MILES, YOU can't get much farther away from Silicon Valley than Madison, Wis. There are more dairy cows in the state than DSL connections. So it is no wonder that when, in 1996, Rod Heller, the 42-year-old founder of FoodUSA.com, went knocking on the doors of big food companies like Sysco to sell his idea for a food exchange, the doors slammed shut as fast as they had opened. "Too geeky" was what they said," says Heller.

Before FoodUSA, Heller was making \$50,000 a year as a food broker. He ped-

dled whatever he could—truckloads of canned mushrooms, cases of tomato sauce—to local groceries. Then Heller read about Jim Manzi, the former chief executive of Lotus who planned to make Industry.Net into a giant network of buyers and sellers of industrial parts. Manzi's venture crashed because he spent lavishly and tried to cover too much. The saga gave Heller an idea.

"Once the client demo is over, all that most food brokers do is take orders. They weren't adding value but were getting 3%–5%. I figured I could do it over the Internet and get to a heck

of a lot more buyers," says Heller.

So Heller wrote a business plan. But unlike Manzi, he kept it simple. He wanted to establish a neutral market for meat. The packers and slaughterhouses would post their meat and finance the transactions; buyers would pay for delivery. FoodUSA would collect 0.5% from the sellers, whose identities remained anonymous until the deal closed.

Heller shrewdly limited the scope of his plan. "Most B2B guys want to build huge, automated, end-to-end systems," he says. But that's too much technology for a lot of meat people. "If you tell people in this industry to put the mouse at the top of their screen, some will lift it up and perch it on top of their monitors. No one is going to spend \$300,000 to tie a system into their back end."

In fact, Heller's operation is so simple it hardly operates as a Web exchange at all. Half of FoodUSA's 46 employees are either salesmen, who call processors for postings, or "trade facilitators" who use the phone to push deals to close.

"We find that people in this business prefer to use our toll-free telephone number," says Heller. "Most of these guys are middle-aged men who have kids in college. His job is dependent on how well he buys meat. There is no way he is going to buy \$100,000 worth of meat without talking to someone."

Since launching in April, FoodUSA has traded about \$10 million worth of meat. It's a good start, but it doesn't come close to covering even payroll.

Heller is a regular speaker at B2B conferences. Let's hope he drums up some cash. FoodUSA will need more than its \$3.3 million initial funding to survive. A number of big companies are opening up their own exchanges.

Says Heller, "What we've built here is a traditional business with an Internet overlay. We are just trying to get them off of the fax and telephone." **F**

BLACK/TOBY

Where I come from

- Entrepreneur
- Recovering Dot Com'r
- Lighting 12 years

What I See

- ⦿ Lighting is on the verge of becoming the next “dot com” boom
- ⦿ Our world will rock over the next 5 years
- ⦿ It is the joining of technology, energy efficiency, and human physiological response
- ⦿ The players in the lighting industry will be shuffled



Evolution

- ◎ For a million years, we were hunters & gathers
 - We spent 90% of our time outside under the blue sky
 - Only light was sun and fire
 - We got up with the sun & went to bed with the sun



Squeezing Evolution

- ◎ 1880 Edison patented light bulb
- ◎ Now we get up before the sun and go to bed after the sun goes down
- ◎ Societal demands versus evolution
 - There wasn't a 3rd shift 150 years ago!



Technological Squeeze

- ⦿ Moving from a glowing piece of metal to a computer chip, LED
- ⦿ Incandescent = 15 lumens/watt
- ⦿ LED = 330 lumens/watt (Cree this year)
 - LEM3-13 predicted 200 lumens by 2020
- ⦿ Add to this that now most of us spend 80%+ of time indoors



Two Radical Changes Coming Together at Once

- We are about to change all our light sources from glowing filaments to computer chips
- Just beginning to understand how the photoreceptor, ipRGC, works and what it turns on and off
- Very difficult to combine both technological and physiological advances



Start with Technology

- Old, stodgy industry with very little change in last 130 years is now changing every 6-9 months
- As a manufacturer, how do you develop, test, market, and make a profit in 9 months before you get bypassed by a competitor's next generation?



Light Sources

- ◎ Literally, every light source in place today can be replaced by an LED
 - MH 400, MH 1000, MH 1500, Par lamps, BR lamps, MR 16, even LED T8 Tubes
- ◎ Lumens/watt & life all exceed traditional light sources
- ◎ Easy to get LPD down to 0.5 watts/sq. ft.



LED Suppliers

- Traditional Lighting is Sylvania, GE, Philips.....
- Chip manufacturers are jumping in
 - LG, Visio, Toshiba
- Chaos is opportunity; many no name competitors popping up
- LM 79 & LM 80 are most reliable testing for efficacy and life



Sensors

- ◎ We get LPD so low, it is hard to cost justify
 - Pay \$100 for a sensor that saves \$3/year in energy
- ◎ Sensor companies are going wireless so we do not have to run wire – lowers cost
- ◎ Still hard to do daylighting until the cost is lowered on controls for individual fixtures



Dimming

- ⦿ This is a total crap shoot, sometimes it works and sometimes it doesn't
- ⦿ Always test first (and that may not help)
- ⦿ 120v line voltage is pretty good
- ⦿ Don't trust 277v line voltage dimming
- ⦿ 0-10 is best bet but have to run wire, soon will be wireless



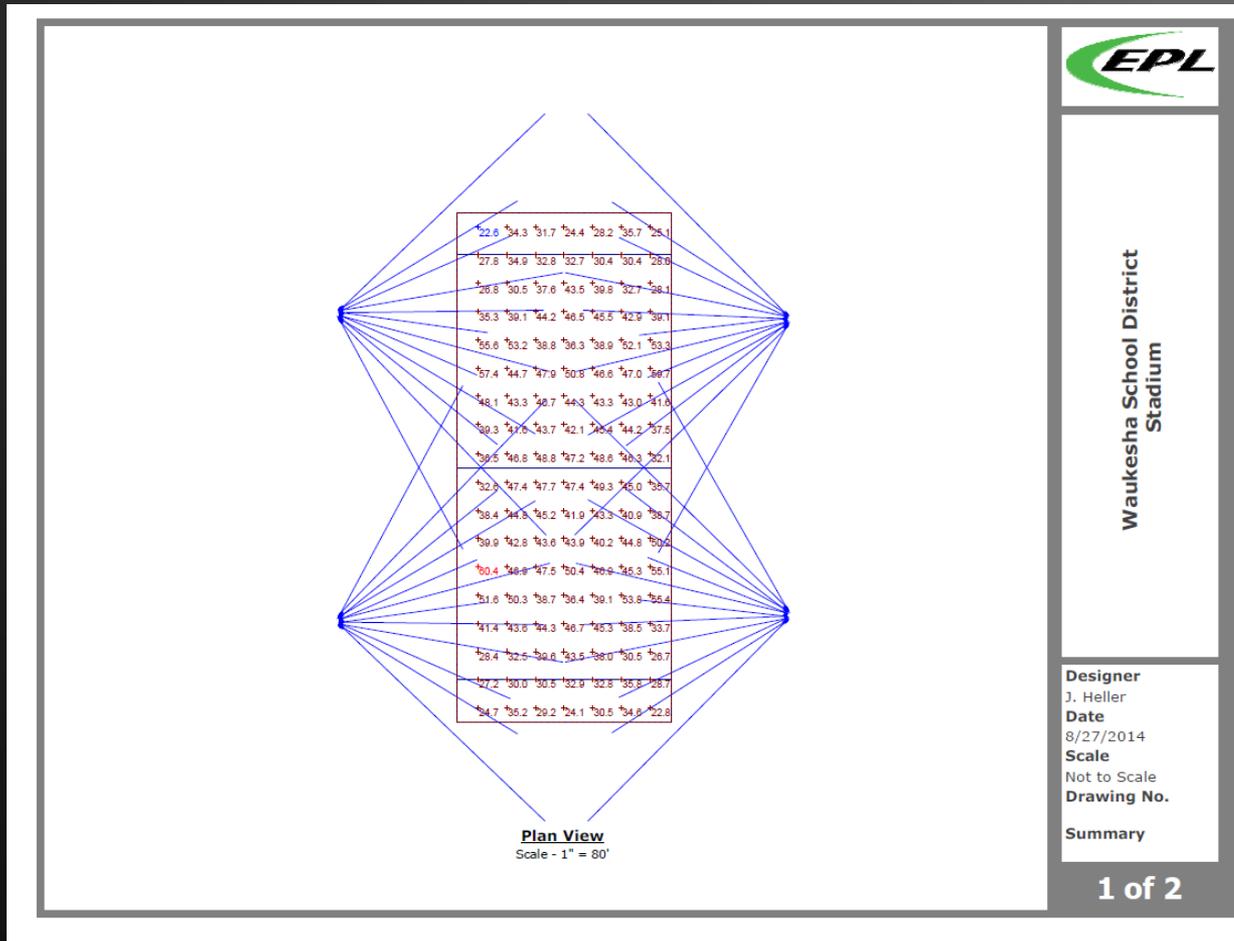
Chips

- ⦿ Are able to handle heat much better
 - Life is longer & greater versatility
- ⦿ Throw out CRI (color rendering index) as a measurement
- ⦿ Ability to replicate the natural spectrum
- ⦿ Emit light differently than HID or fluorescent



Predict the Illumination

-Get a Photometric Analysis!



Waukesha School District
Stadium

Designer
J. Heller
Date
8/27/2014
Scale
Not to Scale
Drawing No.

Summary

1 of 2

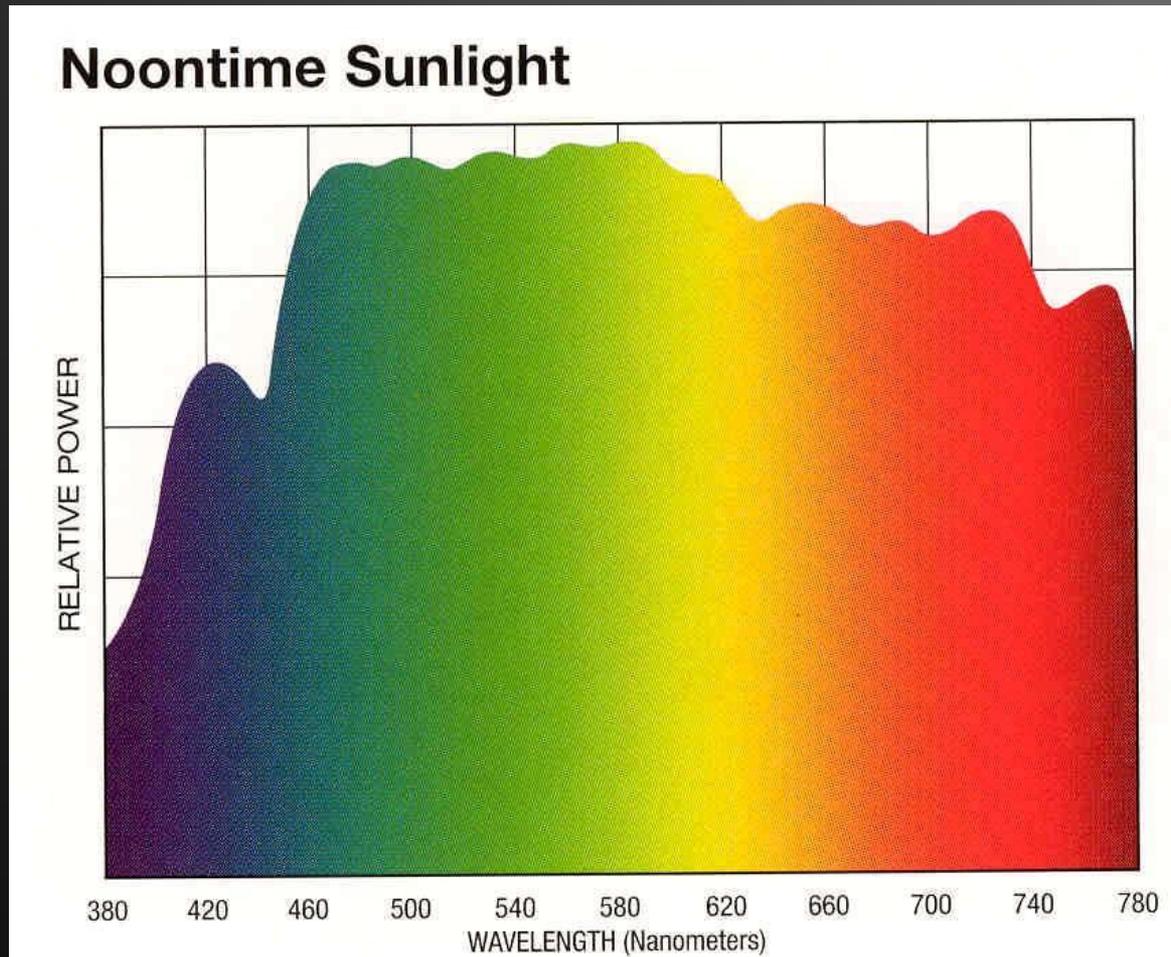


Natural daylight

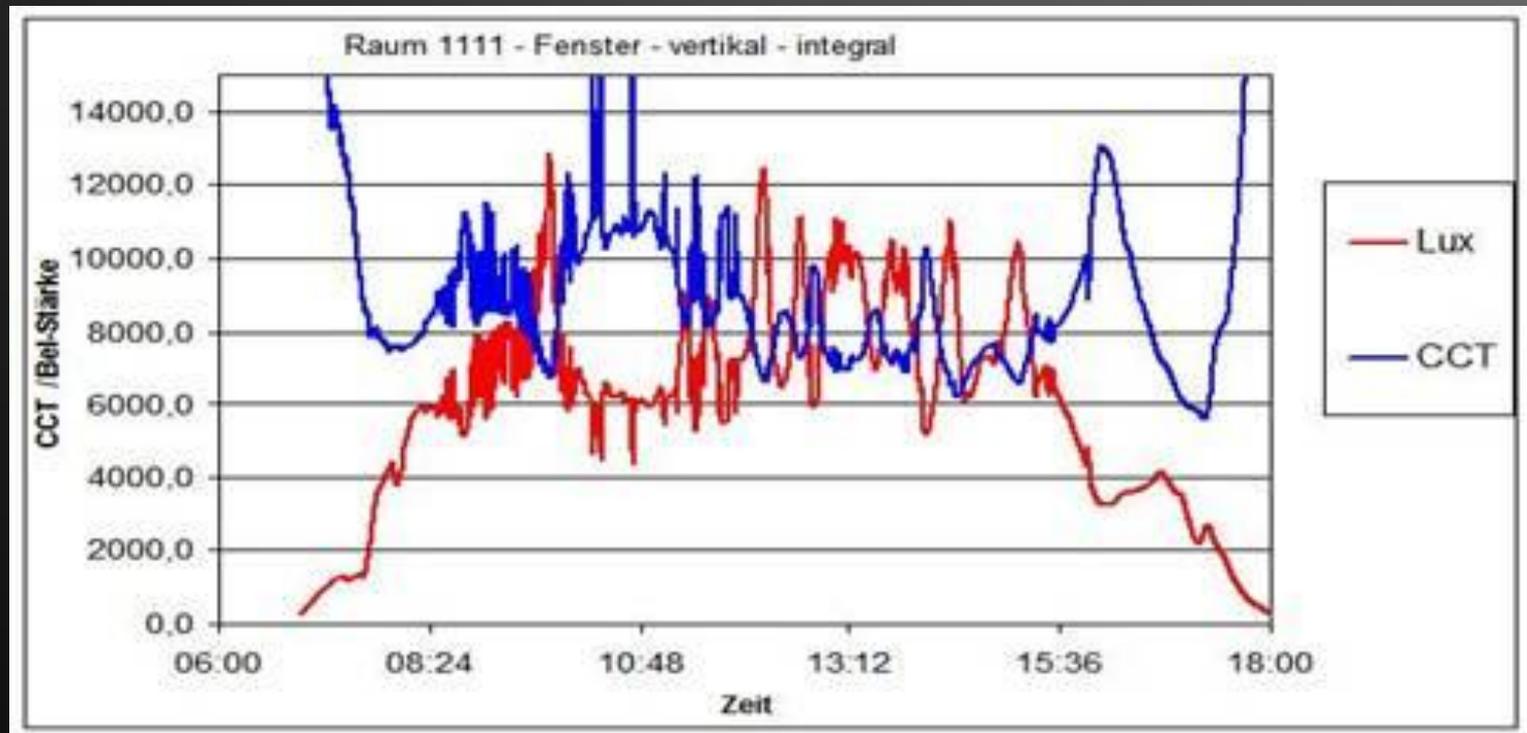
- ⦿ This is the basis of all debate between high kelvin and low kelvin designers
- ⦿ It is about color diversity & reflectivity
- ⦿ If the color is not in the light source, it can not be reflected



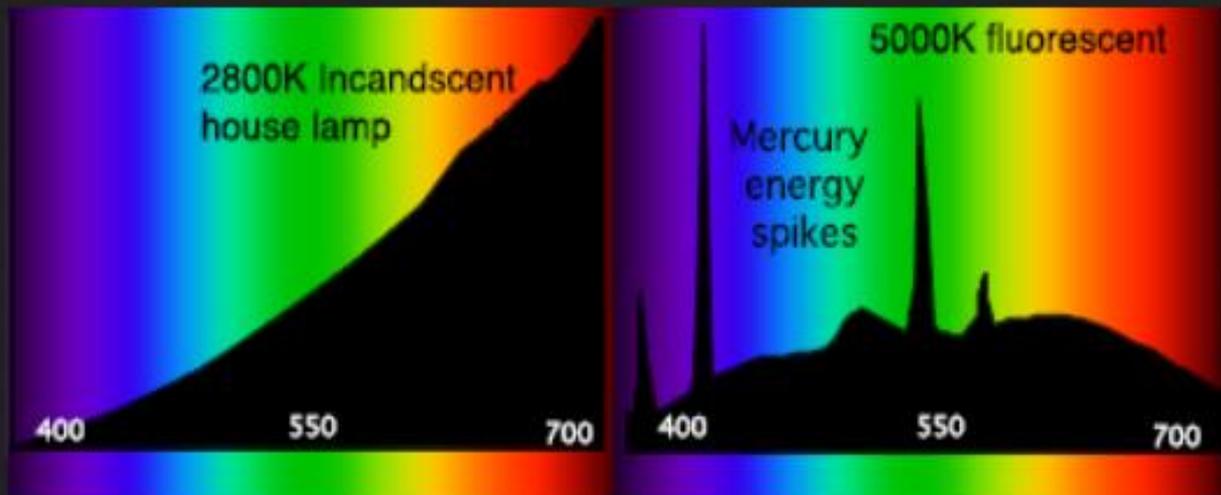
Natural Spectrum



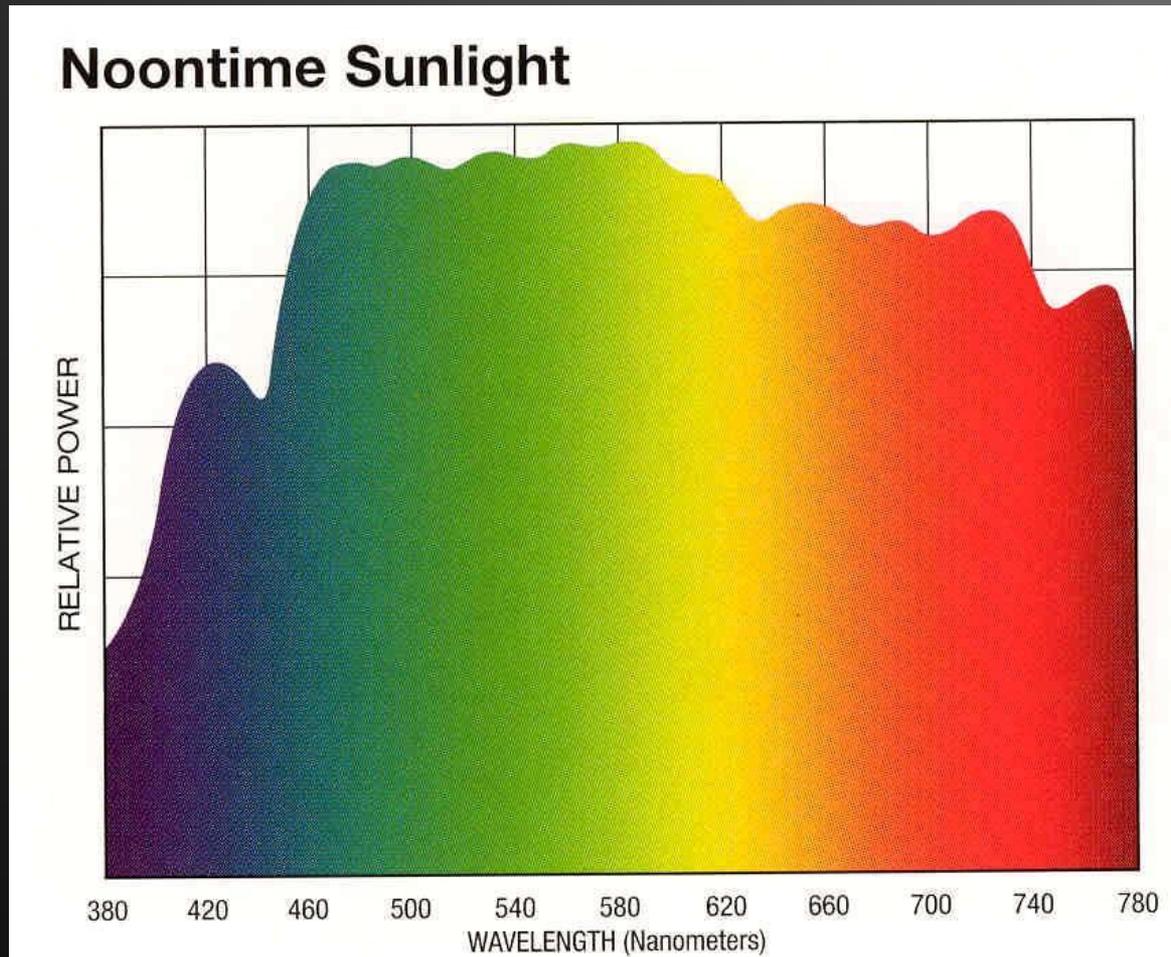
Color Temp During the day



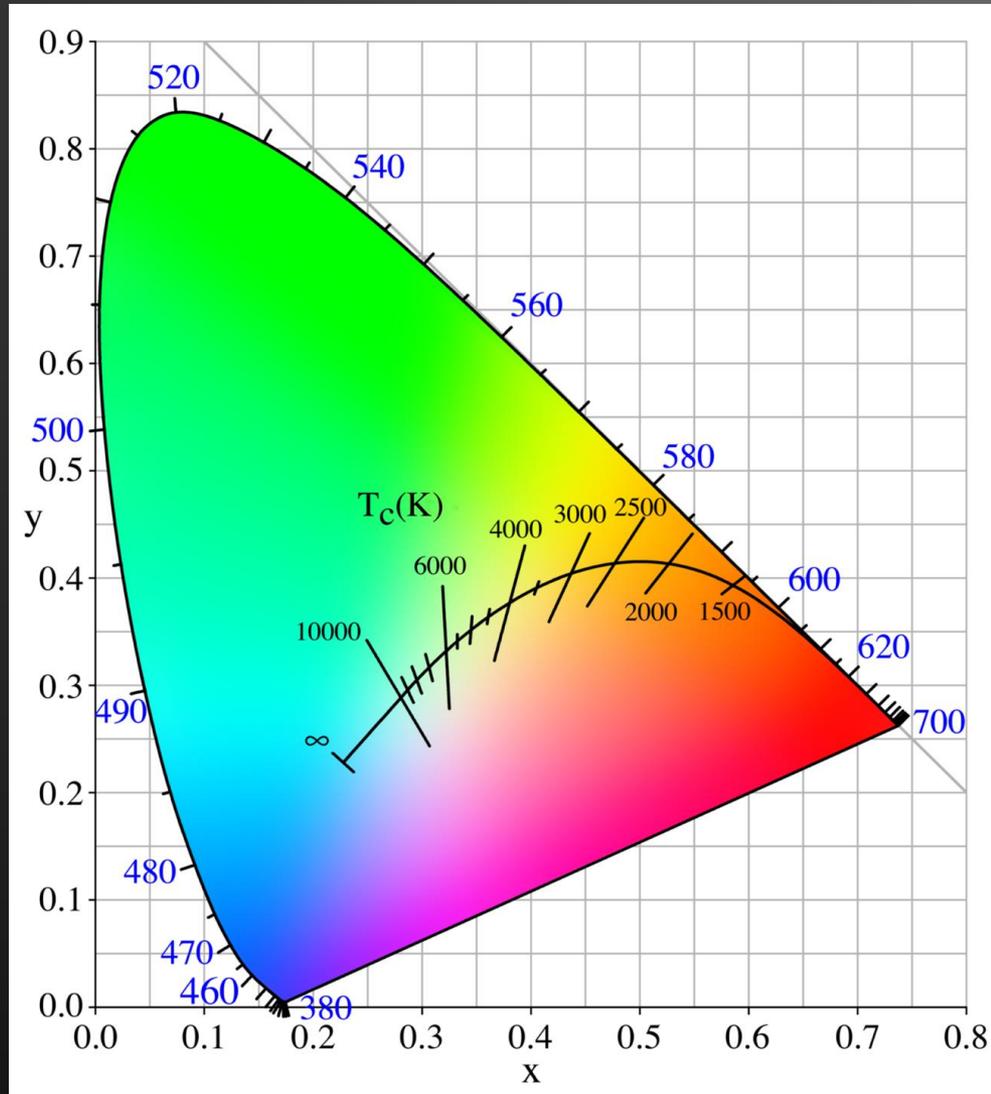
Man Made Spectrums



Natural Spectrum



Color Temperature



Planckian
locus

Problem

- ⦿ Do you design for reflectivity of color?
or
- ⦿ Do you design for human health?
- ⦿ If you light to task (IES Lighting Handbook, 10th edition) with new technology, 70% energy savings is a given

Physiology

- ⦿ Human Physiology
- ⦿ New photoreceptor discovered, ipRGC
 - Intrinsically Photosensitive Retinal Ganglion Cells
- ⦿ Rods, Cones, and ganglion cells
- ⦿ Responsible for keeping our internal body clock in sync

Human Physiology

- ◎ Whenever exposed to light in blue spectrum it resets our body clock
 - This includes cell phone, computers and TVs
 - Download free program f.lux
 - Naturally reset our clock, go camping for a week



Human Physiology

- ◎ Blue light spurs production of Cortisol and suppresses the production of Melatonin
- ◎ These hormones control
 - Breathing rate –faster during the day
 - Body temperature –higher during the day
 - Heart rate –faster during the day
- ◎ Other functions we do not understand yet!

Human Physiology

- ⦿ Without exposure to blue light our body clock will drift
- ⦿ Our body is set to run on a 24 hour and 6 minute day (leap year)
- ⦿ First noticed with study on blind people
 - Some slept through the night, others slept at all different times
 - The optic nerve was not totally severed

Data Points of Out of Sync Clock

◎ 3rd shift

- Women have 60% greater chance of breast cancer
- Men have 50% greater chance of prostate cancer
- In general greater chance of obesity, diabetes, & cardiac disease
- Higher rate of accidents
- Higher health insurance claims



Data Points of Out of Sync Clock

- ◎ 1st shift with no blue light
 - People who work near window, sleep 44 more minutes/night
- ◎ People who sleep with TV on in general have 20% more health problems
- ◎ People who live in cities with lots of sky glow in general have 20% more health problems

Why

- ◎ “It is not about trees or birds outside a window; it is about photons hitting the eye!” –Dr. Steve Lockley Harvard School of Medicine

When the Body Clock is IN Sync

- We reduced errors by 26% on 3rd shift at NASA Mission Control by installing 8000k in the break rooms
- Believe we can reduce rates of obesity and cancer by flipping night into day
- We know we can increase alertness to reduce accidents



Lighting's Purpose

- Vision
- Health, Productivity, and Safety
- This is the environment we all strive for
- We get this right, we save 70% on energy as a side benefit



How Do We Get There?

- Tunable lighting
- Rich blue light during working hours
 - That is our “day” regardless of shift
- Longer wave length light in evening
 - Yellow
- Even longer wave length at night
 - orange, red –minimal circadian disruption
- Keeps us alert and ready to go during the day and helps us sleep more soundly at night!



Office Environment

- ◎ Generally computer work
 - Avoid windows that cause glare on screen
 - Lower light levels
 - Tunable ambient & task light sources
- ◎ Response I received after installing 8000k
 - Not tired at end of day
 - Sleep better at night
 - Easier to inspect and see small parts



School Environment

- Rich blue to wake them up first thing in the morning
- Rich blue increases reading speed & comprehension by 10%
- Higher illuminance and rich blue will increase concentration
- Warmer light will calm children down after recess



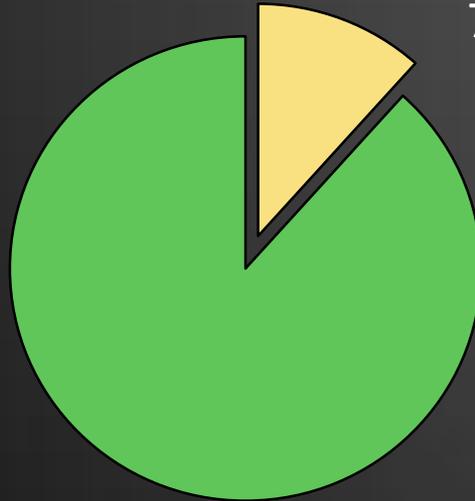
Health Care Environment

- ◎ Blue light for staff to increase alertness
- ◎ Blue light for patients, change to warm in evening to orange/red at night
- ◎ 3rd shift staff must sleep in total dark, quiet environment during day
 - No disruptions, must have normal 24 hour cycle

48% Higher Mortality Rate

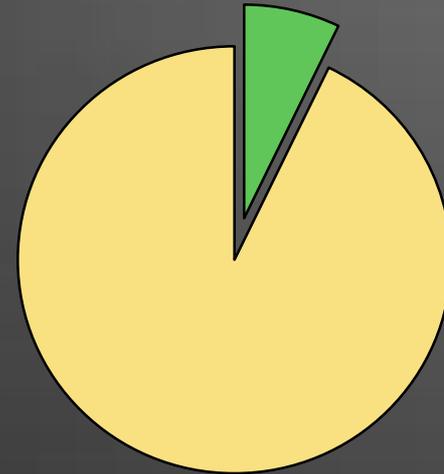
Dull Room

Mortality Rate
12%



Sunny Room

Mortality Rate
7%



Police, Fire, 911, Factory, etc.

- ◎ Blue light for staff around the clock for alertness
- ◎ 3rd shift staff must sleep in total dark, quiet environment during day
 - No disruptions, must have normal 24 hour cycle

Senior Living

- ◎ Lots of blue during the day
 - Need to penetrate the yellowing of the lens
- ◎ Warm at night
 - Calms them down
- ◎ Orange/reddish at night
 - Prevents tripping or falls from staff
- ◎ Same strategy as daylighting
 - Proven to help patients sleep through the night



Daily Life

- ⦿ Blue light first thing in morning shuts off melatonin and starts cortisol production
- ⦿ Enhances performance
 - Alertness & accuracy
- ⦿ Change to warm in evening for calming affect and to fall asleep
- ⦿ Increase visual acuity

Seasonal Affective Disorder

- ⦿ For a million years we got up with the sun and went to bed with the sun
- ⦿ Society demands regular work schedule
- ⦿ Result: Increase in SAD in fall and winter
- ⦿ High Kelvin light first thing in the morning will alleviate SAD in over 50% of population*

*G.Glickman, Biol Psychiatry 2006;59:502-507



High Kelvin & Visual Acuity

- Blue shrinks size of pupil
- Focuses light more tightly on fovea
- Change from 4100K to 5000k to increase visual acuity by 25% at same illuminance (fc)
- Use for fine tasks
 - Assembly, sewing, reading, etc

Sports Teams

- ⦿ Need to have circadian rhythm peak while performing
- ⦿ West coast to east coast W-L ratio drops 10%
- ⦿ Adjust training and lighting 3 hours earlier to peak at game time
- ⦿ East to West not as big a deal, just extending the day
- ⦿ Do the same traveling to Europe



Bottom Line

- ⦿ Healthy lighting and healthy darkness are inextricably linked – must have both
 - Most people in western countries do not get enough blue light
- ⦿ Base your light choices on science



Affect on Energy Code

- ⦿ Throw out energy code completely and base light choices on human health
- ⦿ Do this right and 70% energy savings result
- ⦿ LPD's over .6 are for designers who do not care
- ⦿ Cost/benefit ratio of controls are questionable
- ⦿ Lighting will easily be moved off the grid
 - 20% of consumption



Where Are We Going?

- ⦿ Utilities need to create new business model
- ⦿ Regulators do not know how to respond
- ⦿ Google, Apple, Cisco, & Qualcomm are coming into the space....connectivity
- ⦿ Borders Books, Circuit City, Kodak
 - Who lives; Who Dies; Who's next?



Rodney Recommendations

- Stay with Tier 1 manufacturers
- If going to lower Tier, test them out and be prepared for the cost of replacements
- Request LM79 & LM80
 - Don't accept UL, Energy Star etc
 - Do NOT base decisions on DLC
 - I like Seattle Lighting Lab
- Get photometrics for common areas
- Understand where new fixtures are more cost effective than retrofits



Thank You & Questions

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