Investigating the Trade-Off between Luminous Efficacy of Radiation and Color Rendering Index

November 7, 2013

Lorne Whitehead
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Luminous Efficacy of Radiation (LER) / Color Rendering Index (CRI) Trade-off study commencing with:

- Kevin Houser, USA
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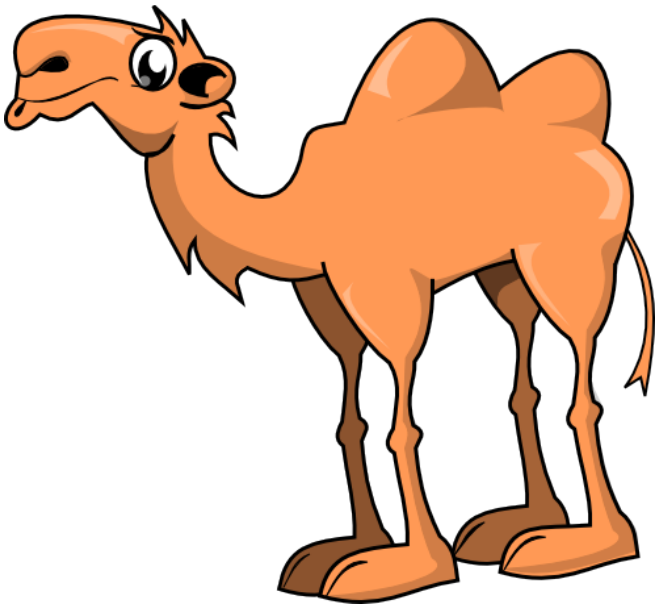


“I've searched all the parks
in all the cities
and found no statues
of committees.”

G. K. Chesterton

G. K. Chesterton, by E. H. Mills, 1909

Born	Gilbert Keith Chesterton 29 May 1874 Kensington, London, England
Died	14 June 1936 (aged 62) Beaconsfield, Buckinghamshire, England
Occupation	Journalist, Novelist, Essayist

The need for international consensus:

USA, while large , is only 20% of world economy.

The next ten economies are:
China, Japan, Germany, France, Brazil,
UK, Italy, India, Russia, Canada

They comprise 50% of the world economy.

What is vision for?

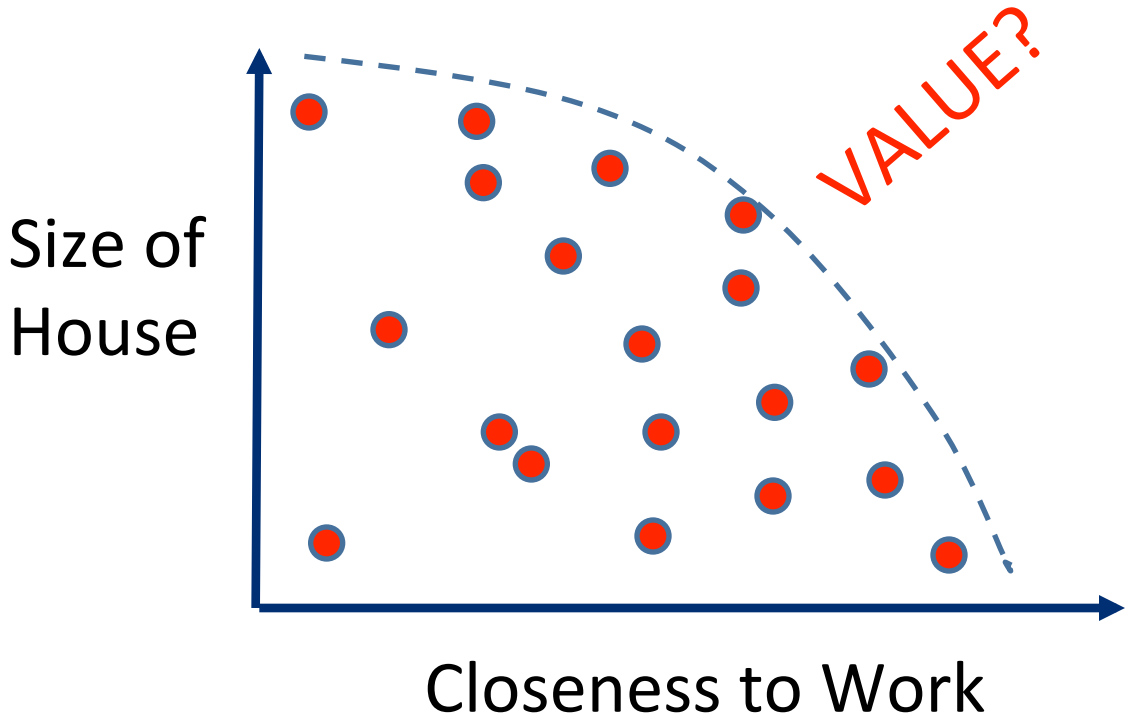
1) Seeing shapes well
2) Seeing color well
3) Seeing the brightness and color of light itself
4) Feeling the timing of day and night

What is vision for?

1) Seeing shapes well
2) **Seeing color well**
3) Seeing the brightness and color of light itself
4) Feeling the timing of day and night

Picture this scenario:

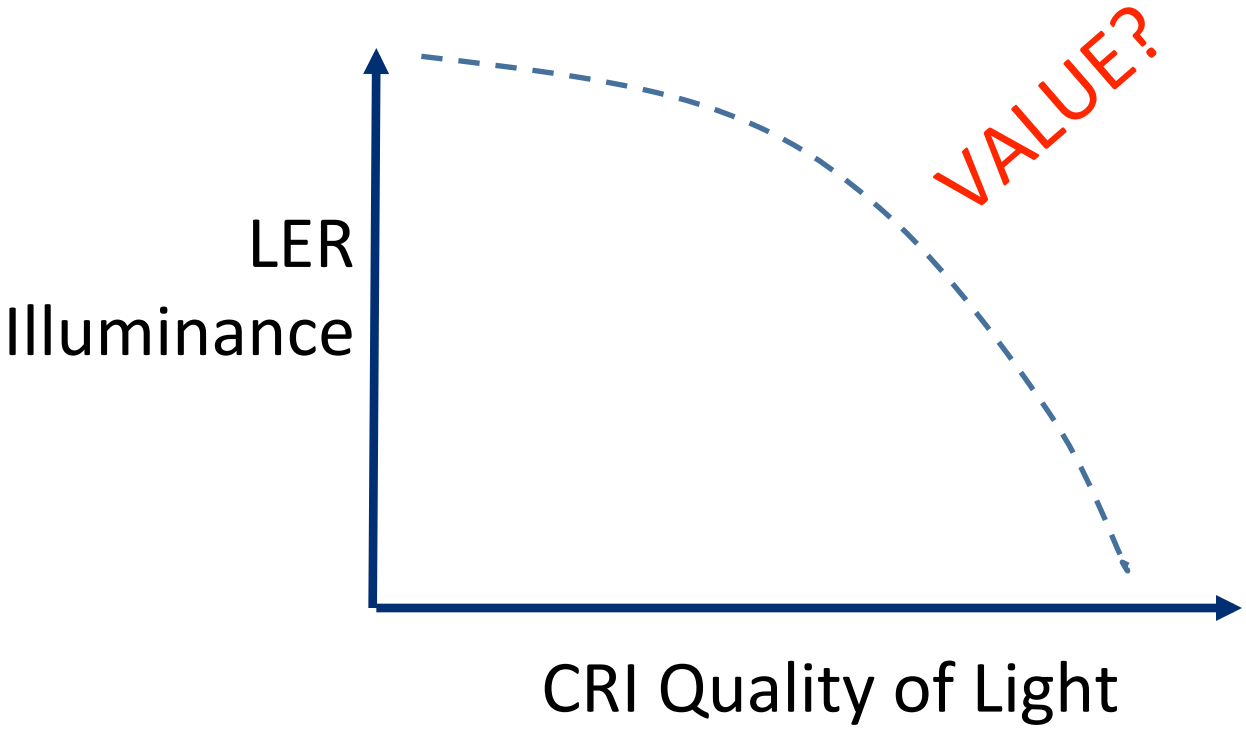
You have a fixed sum and plan to purchase a house. There's a purchase trade-off:



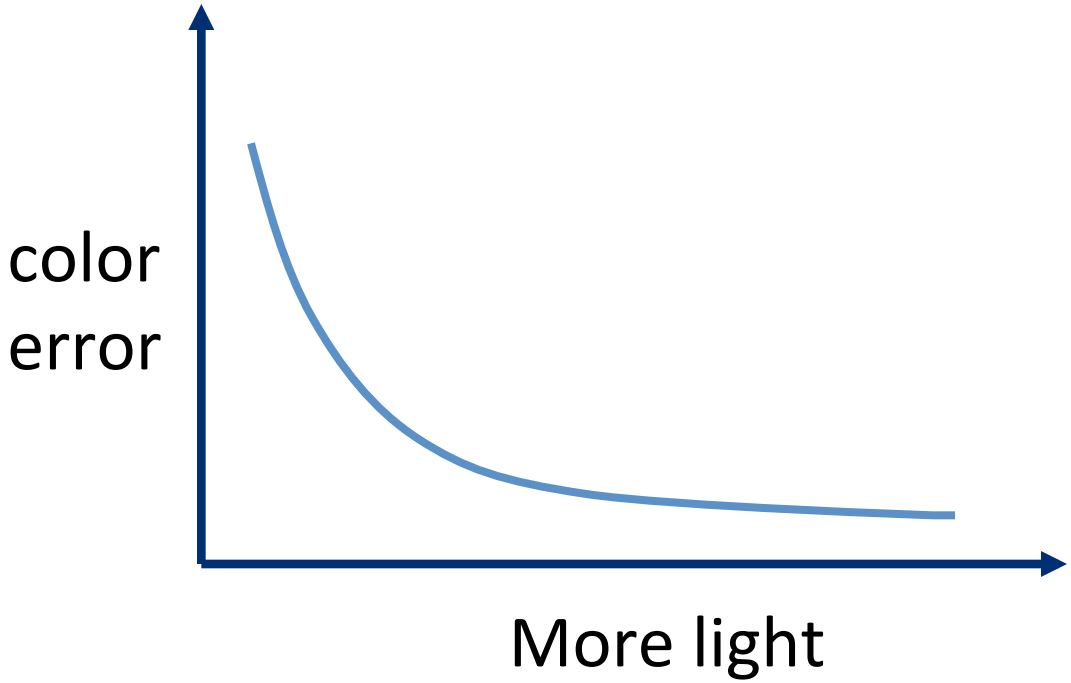
LER vs. CRI trade-off

You have a fixed power budget.

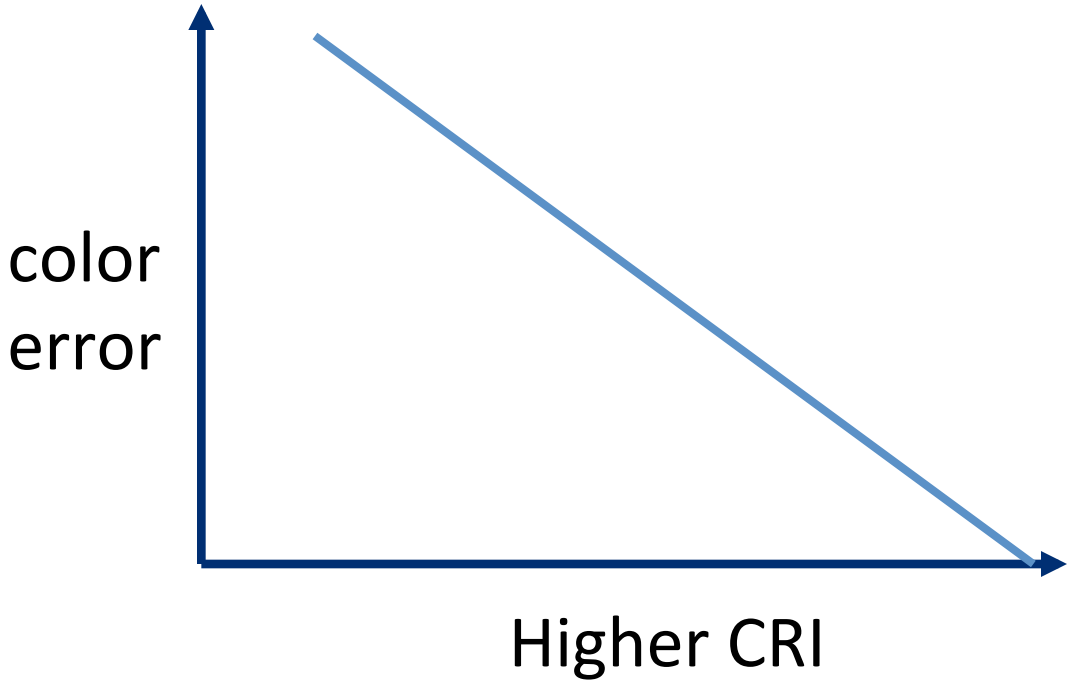
There's a spectral design trade-off:



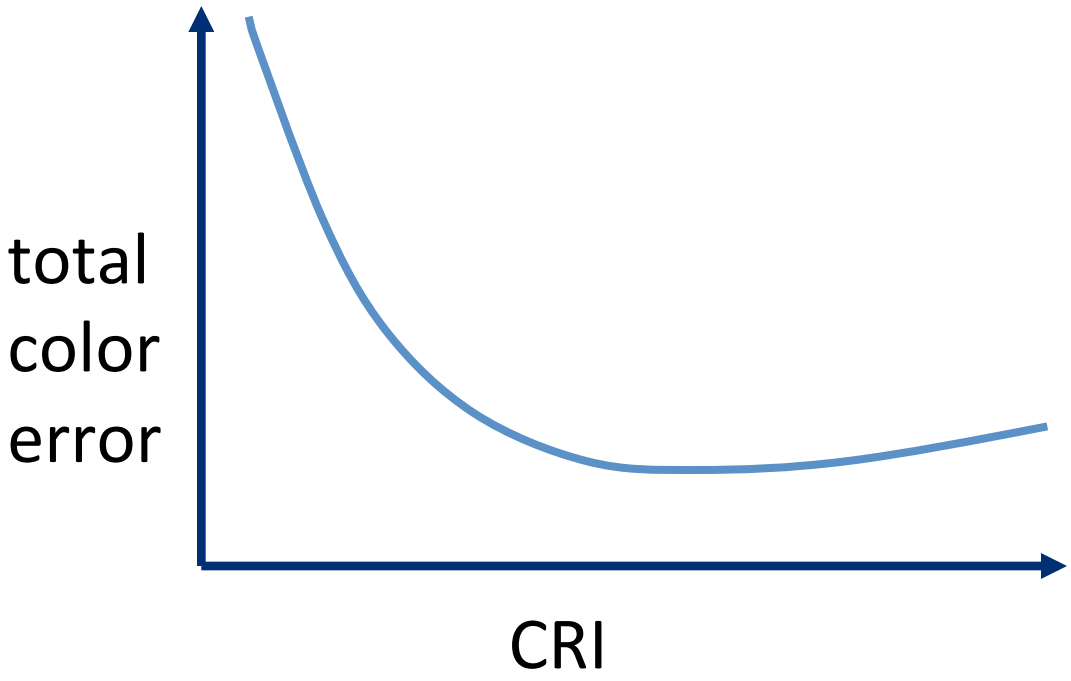
Increasing illuminance reduces color error:



Increasing CRI reduces color error:



Sum of dim-light color error & CRI color error:



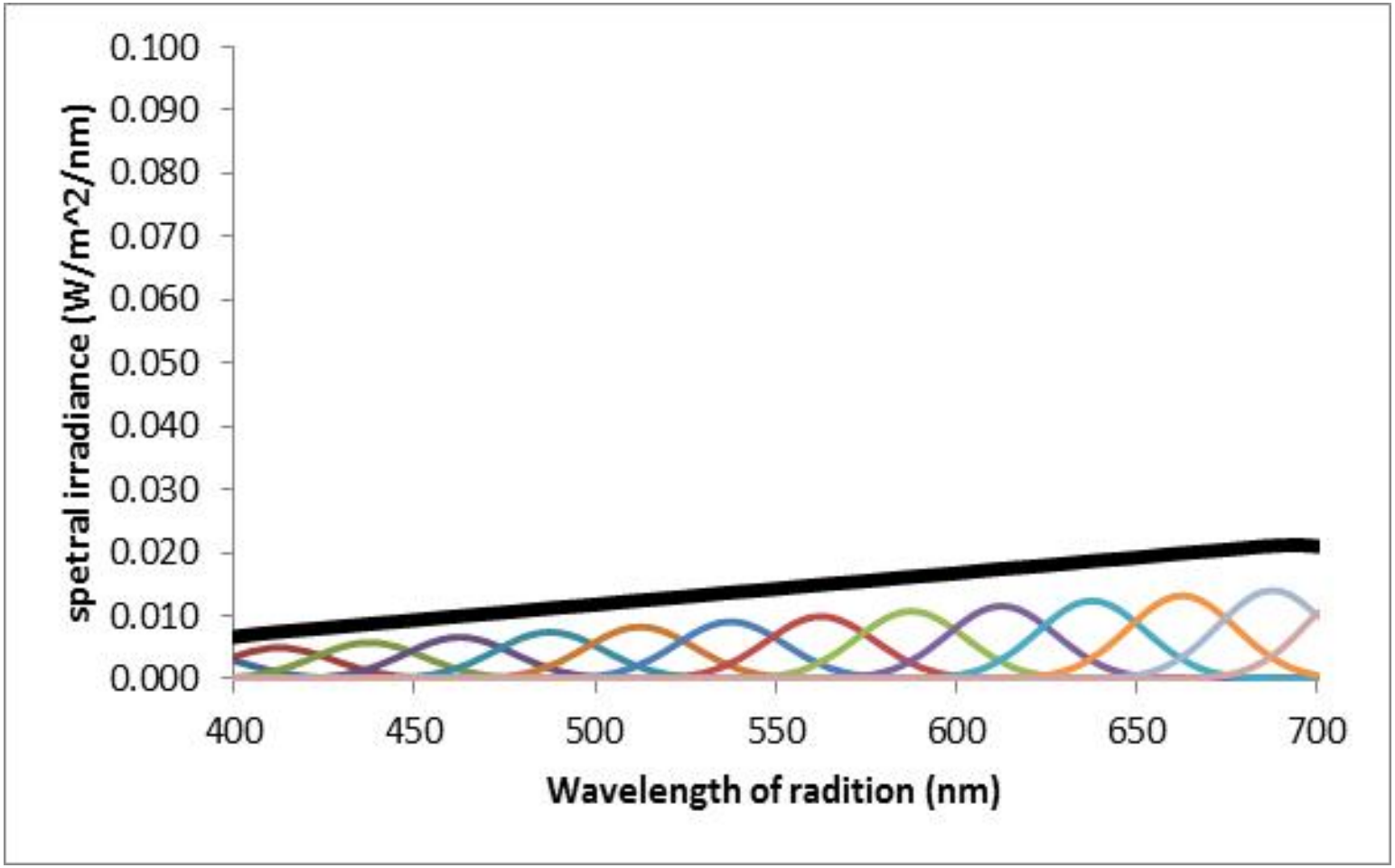
Hypothesis:

In a given setting,
with a given irradiance having a given CCT,
people will have a preferred value of CRI:

Too high → too dim Too low → too poor color

How can we experimentally test this?

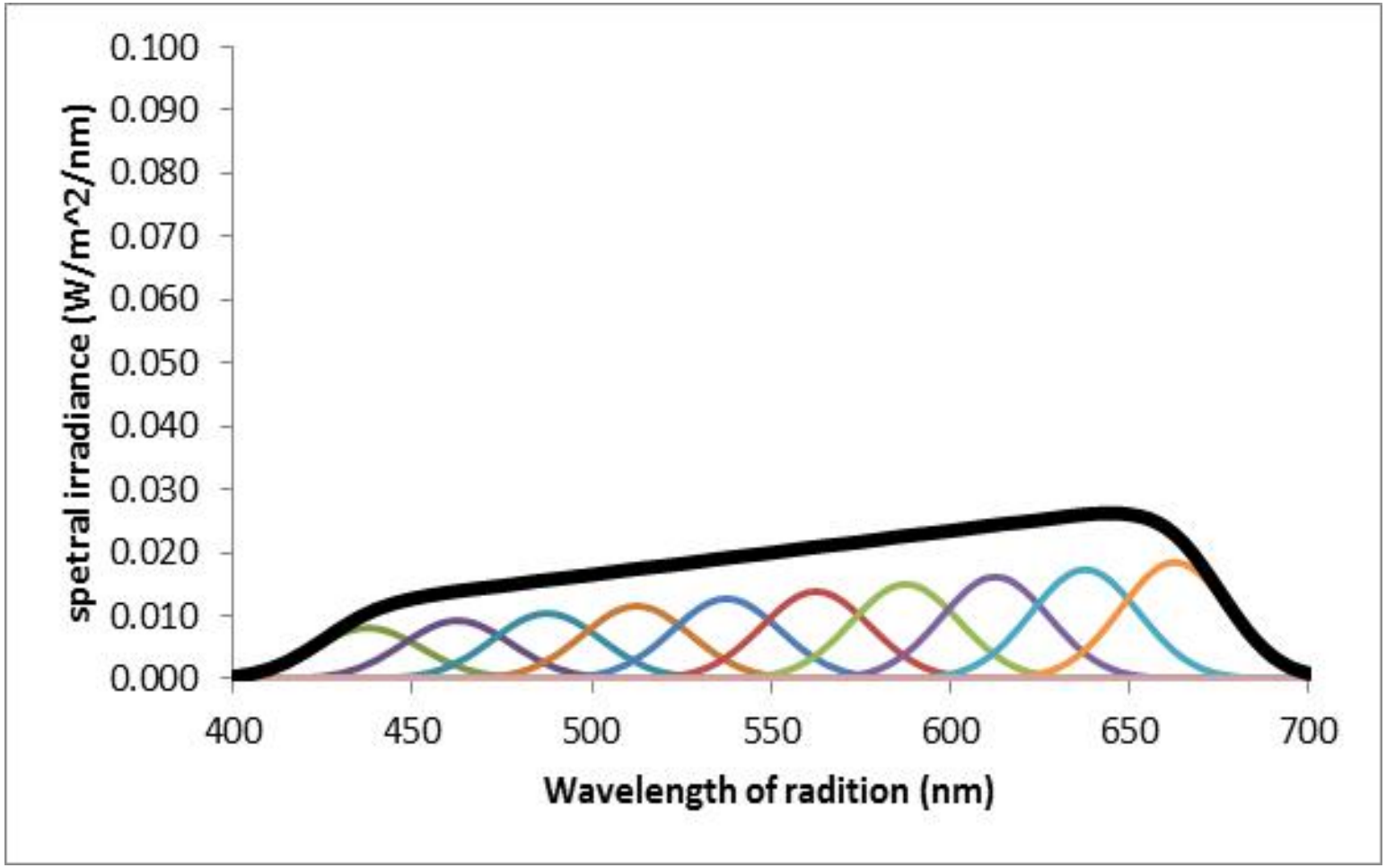
Ev = 200 lux CRI = 100



Ee = 2 W/m^2 CCT = 3500 K

How can we experimentally test this?

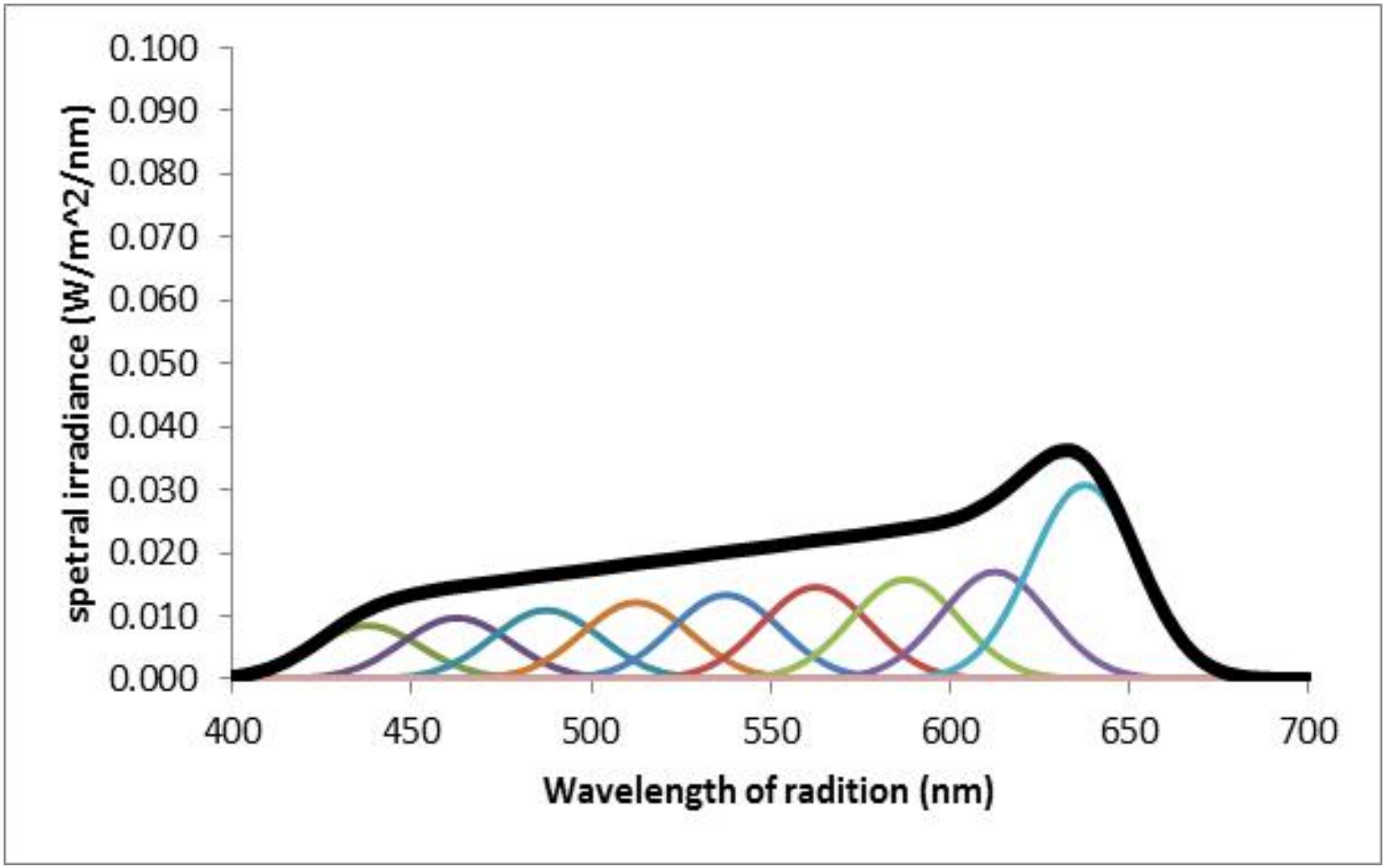
Ev = 300 lux CRI = 97



Ee = 2 W/m^2 CCT = 3500 K

How can we experimentally test this?

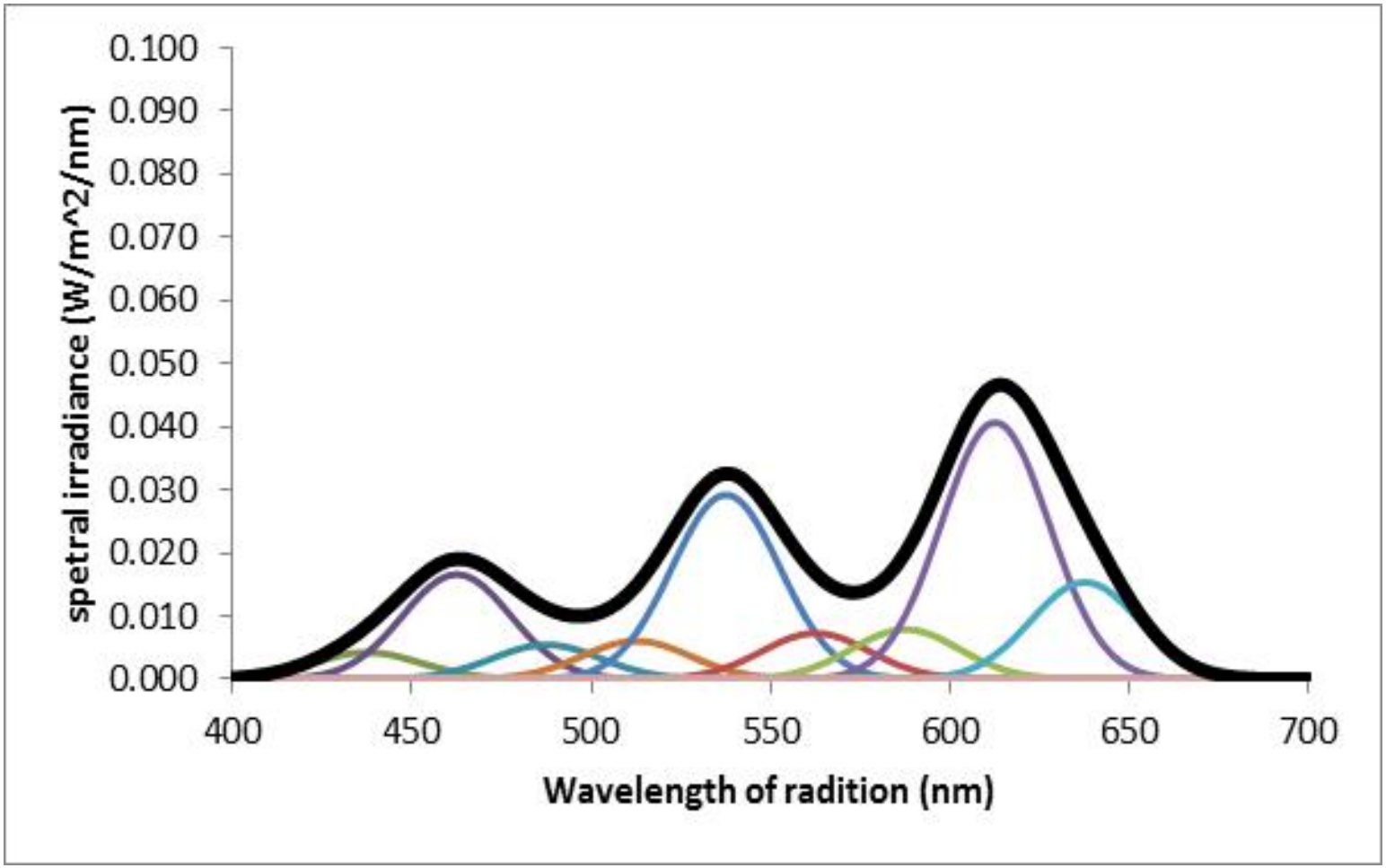
Ev = 400 lux CRI = 95



Ee = 2 W/m^2 CCT = 3500 K

How can we experimentally test this?

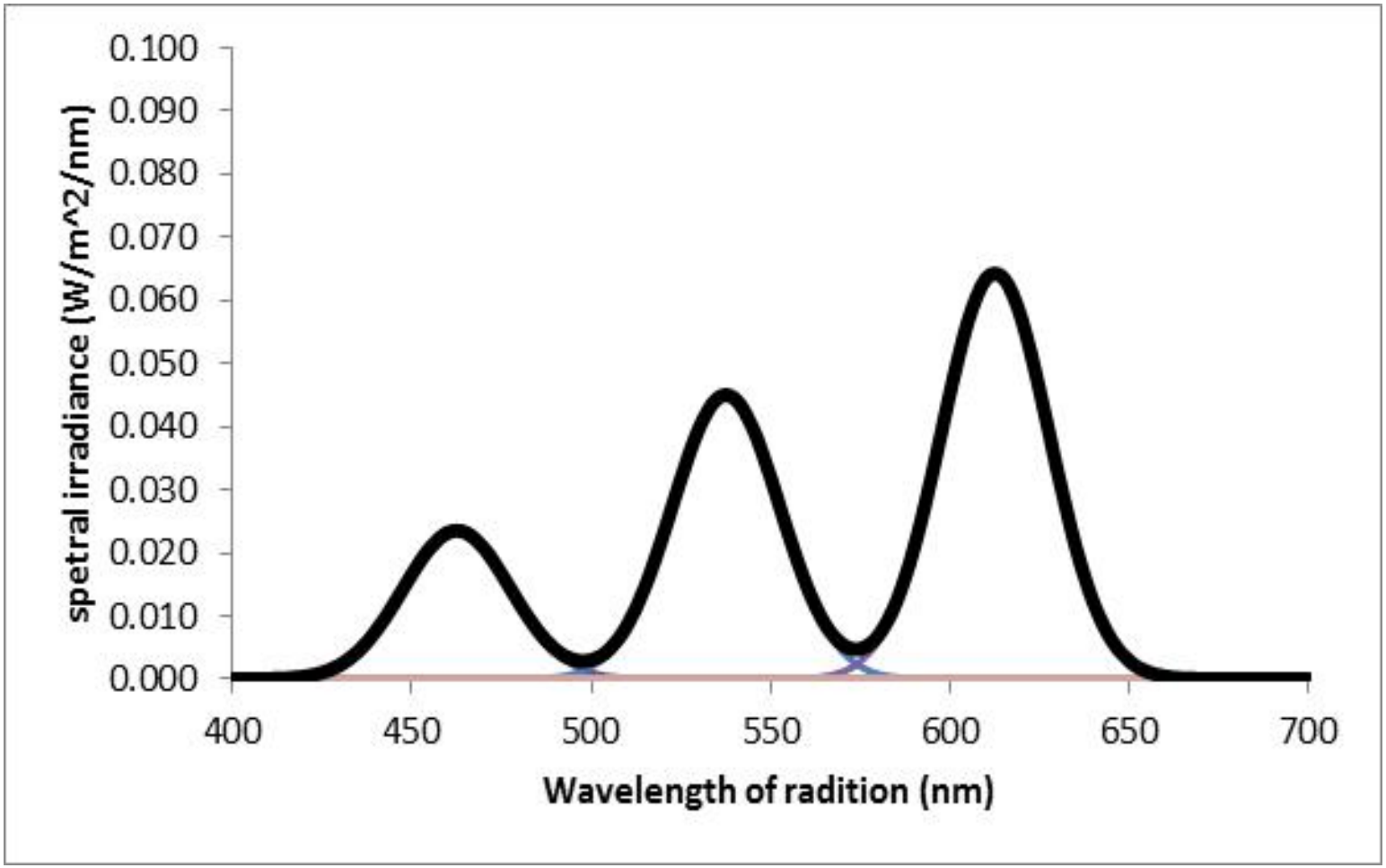
Ev = 500 lux CRI = 80



Ee = 2 W/m^2 CCT = 3500 K

How can we experimentally test this?

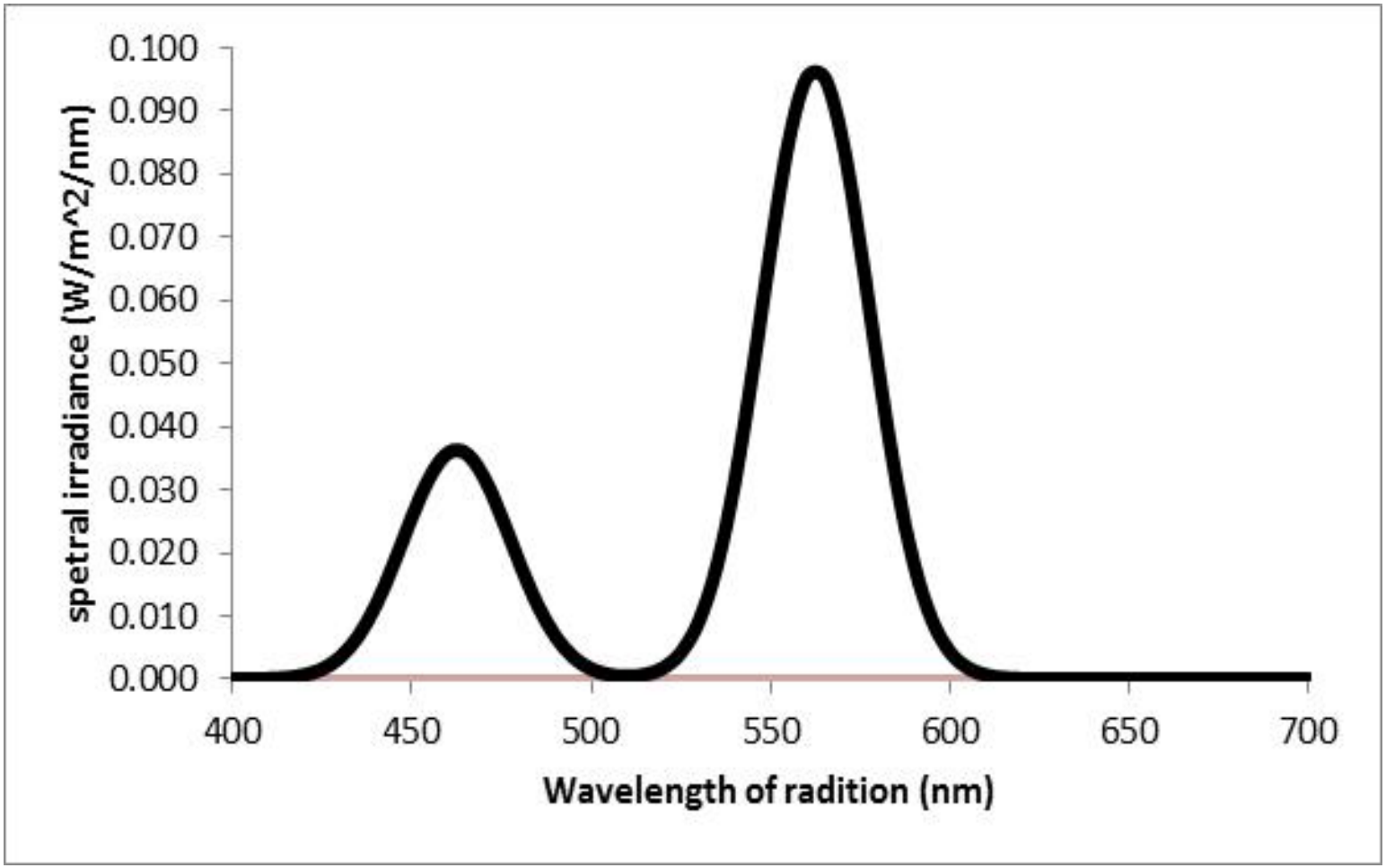
Ev = 600 lux CRI = 70



Ee = 2 W/m^2 CCT = 3500 K

How can we experimentally test this?

Ev = 700 lux CRI = 50



Ee = 2 W/m^2 CCT = 3500 K

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