

# How to improve visual clarity?

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# Which picture do you like more? Where is the weather more sunny?



Original image, with relatively muted colors.



$L^*C^*h^*$  (CIELAB) chroma increased 50%.

# Human Perception

2 booths

3 images (ISO: N2 Flowers, ISO N7: Threads, ISO N1: Woman with glass)

26 individuals

Luminance set equal in both booths

Compare right lamp with left lamp

Difference was calibrated to the Inc-Inc.Reveal<sup>®</sup> \* pair.

## Lamp pairs tested:

1	Inca. Standard	FL_1 Reveal <sup>®</sup>
2	FL_2 Reveal <sup>®</sup>	FL_1 Reveal <sup>®</sup>
3	FL Standard	FL_1 Reveal <sup>®</sup>
4	FL Standard	Inca. Reveal <sup>®</sup>
5	FL Standard	Inca. Standard
6	FL_2 Reveal <sup>®</sup>	Inca. Standard
7	FL_2 Reveal <sup>®</sup>	FL Standard
8	FL_2 Reveal <sup>®</sup>	Inca. Reveal <sup>®</sup>
9	FL_1 Reveal <sup>®</sup>	Inca. Reveal <sup>®</sup>
10	Inca Standard	Inca. Reveal <sup>®</sup>

Y:

Preference scores: right vs. left

Left one  
preferred

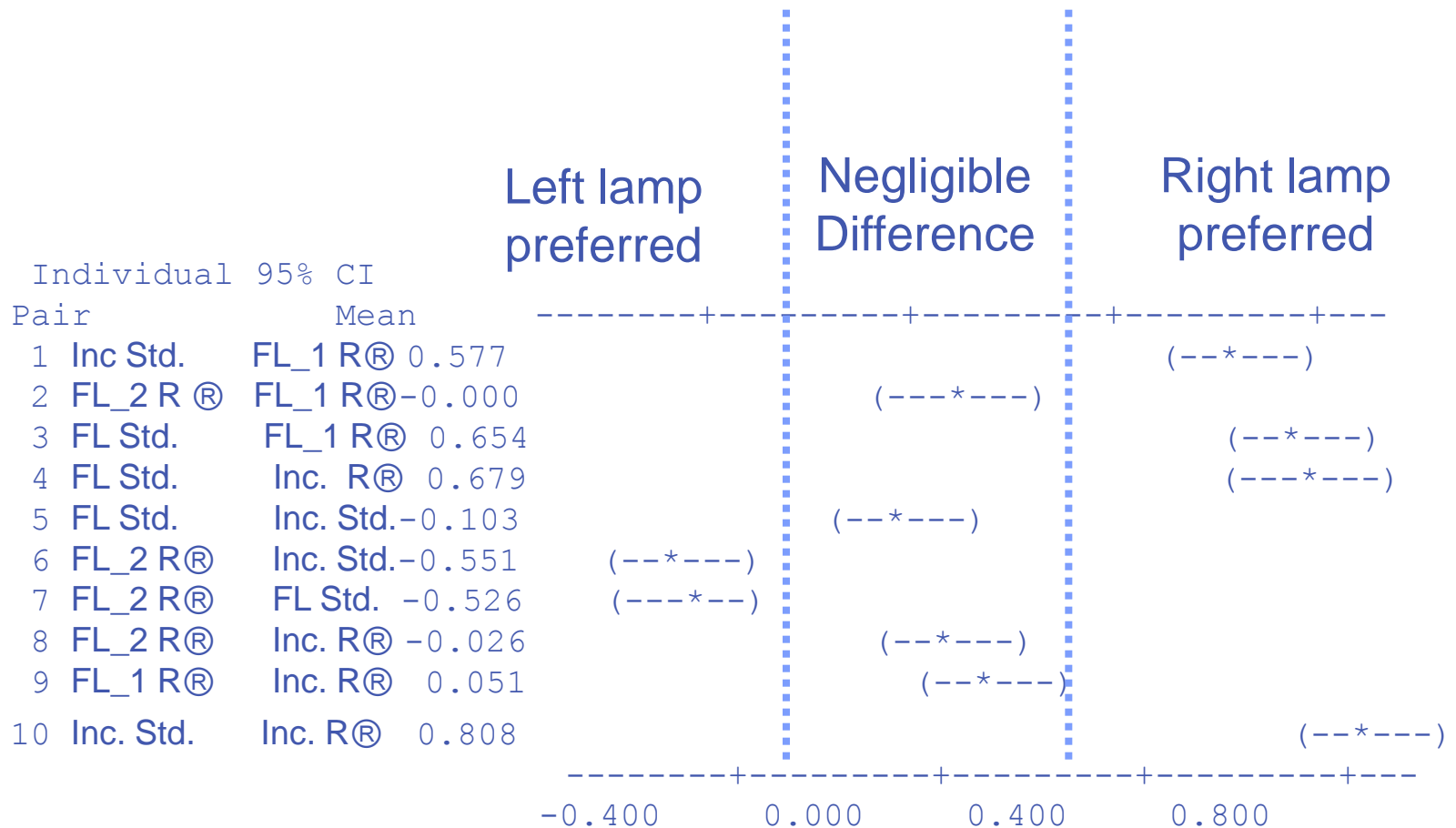
Right one  
preferred

-5

0

+5

# Preference of Reveal<sup>®</sup>-like performance confirmed

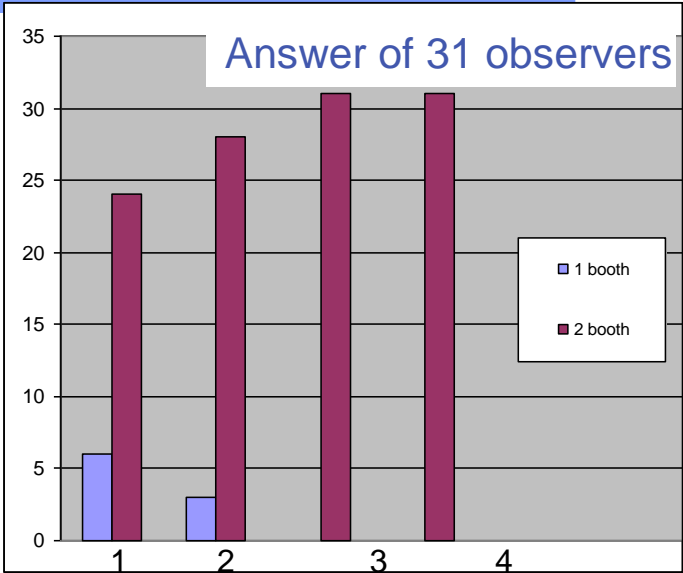


# Booth test

## Standard 300lux



## Reveal<sup>®</sup> 260 lux



### Questions:

- 1, Which is more colourful
- 2, Where are the contrasts sharper
- 3, Where is the white brighter
- 4, Where is the overall brightness higher



# Pattern recognition of color deficient individuals

Standard 300lux

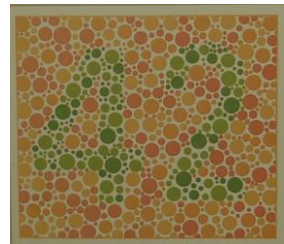
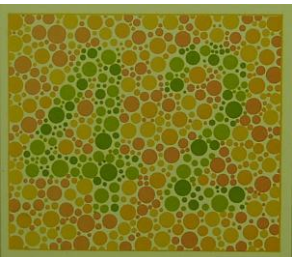


Reveal® 260 lux



Correct answers

	Standard	Reveal
<b>Individual #1</b>	9	12
<b>Individual #2</b>	16	18
<b>Individual #3</b>	13	21
<b>Individual #4</b>	18	20

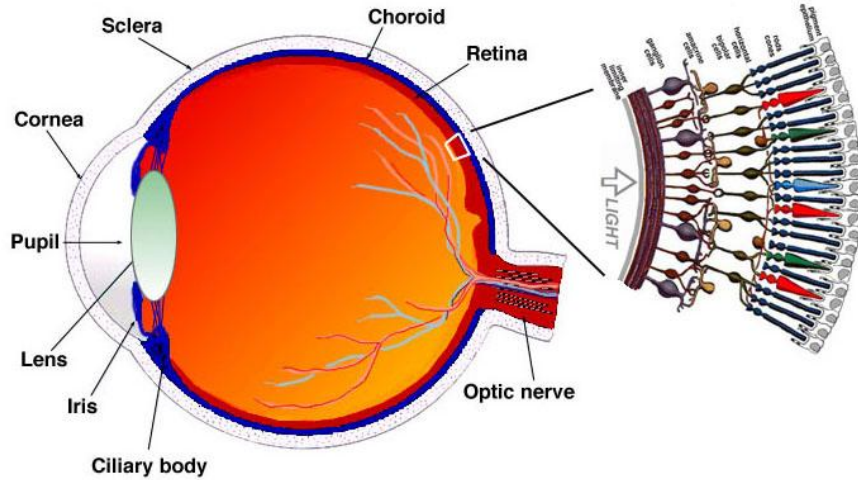


# Current metrics for quality of light

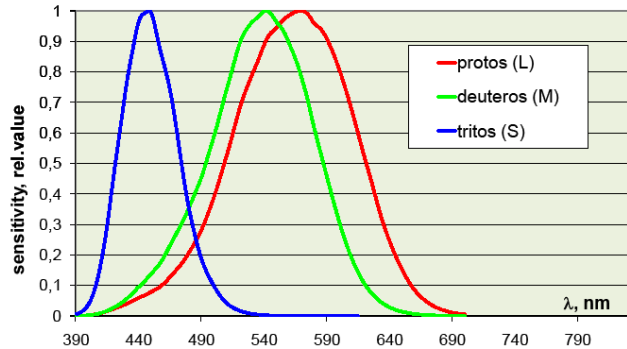
	Standard Incandescent	Reveal <sup>®</sup> Incandescent	Standard FL	Improved visual clarity Reveal <sup>®</sup> FL
Ra	100	78	80	72
R <sub>g</sub>	100	14	-12	23
Ri av.	100	74	68	64.1
Preference	Medium	High	Medium	High

Do they reflect perception test results?

# Vision process

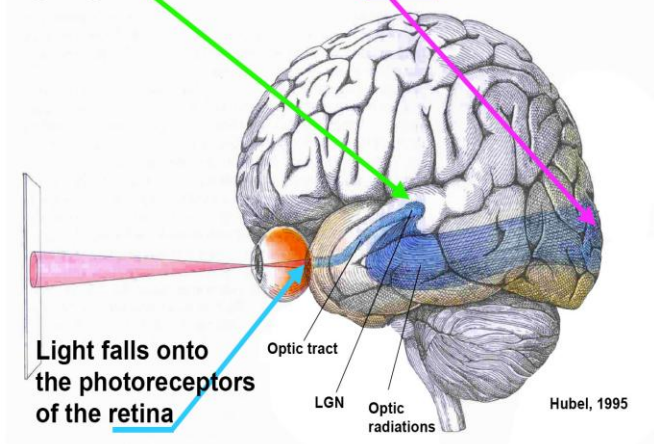


Human eye and retina

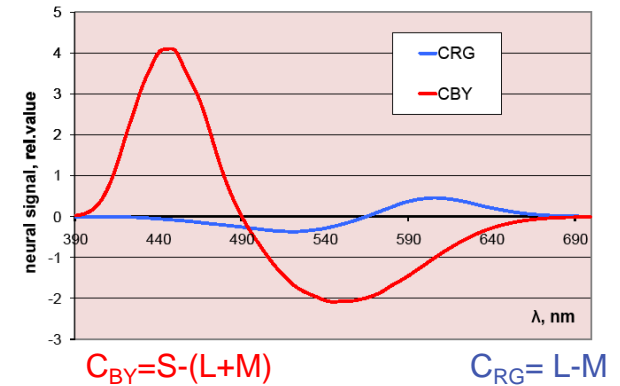


Spectral response curves of cone cells

Thalamus (LGN) serves strategic role in gating of information flow to cortex



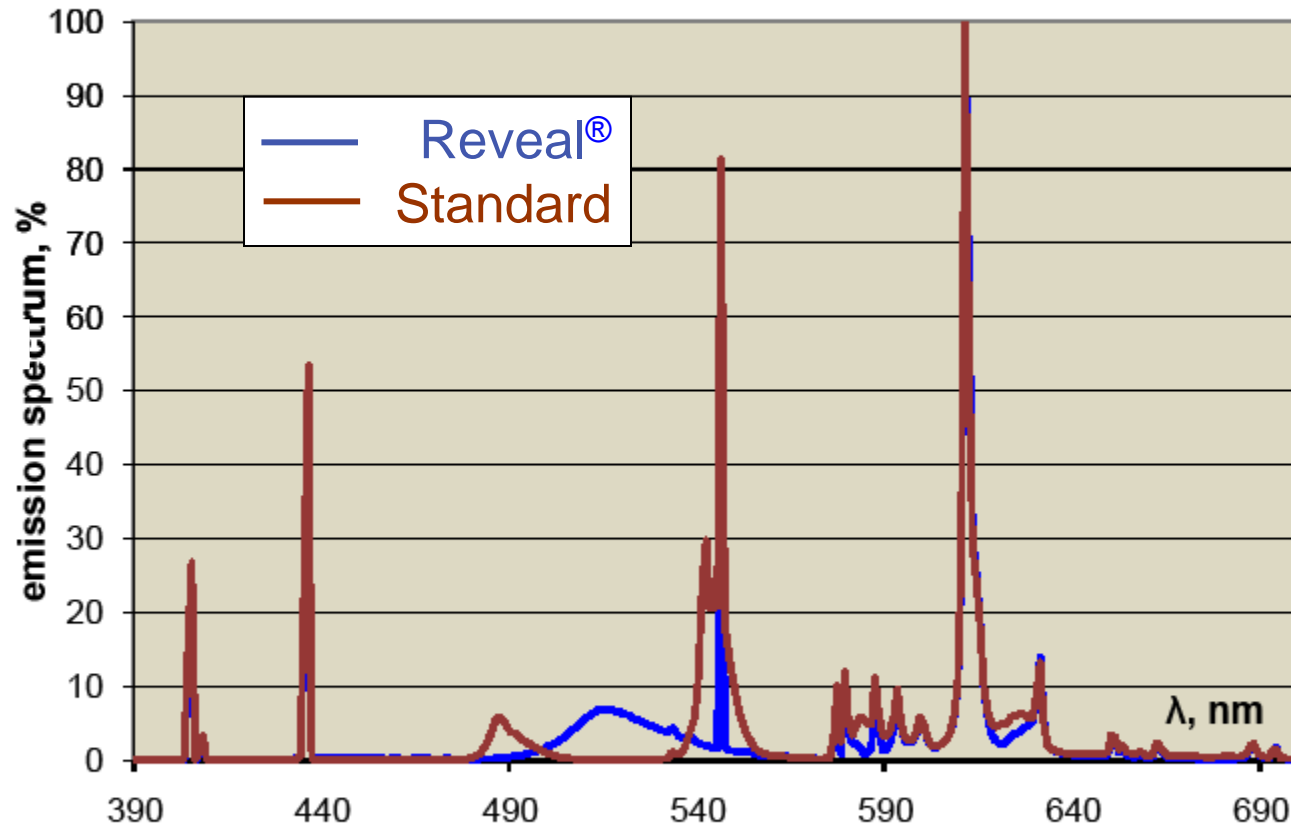
Visual pathway



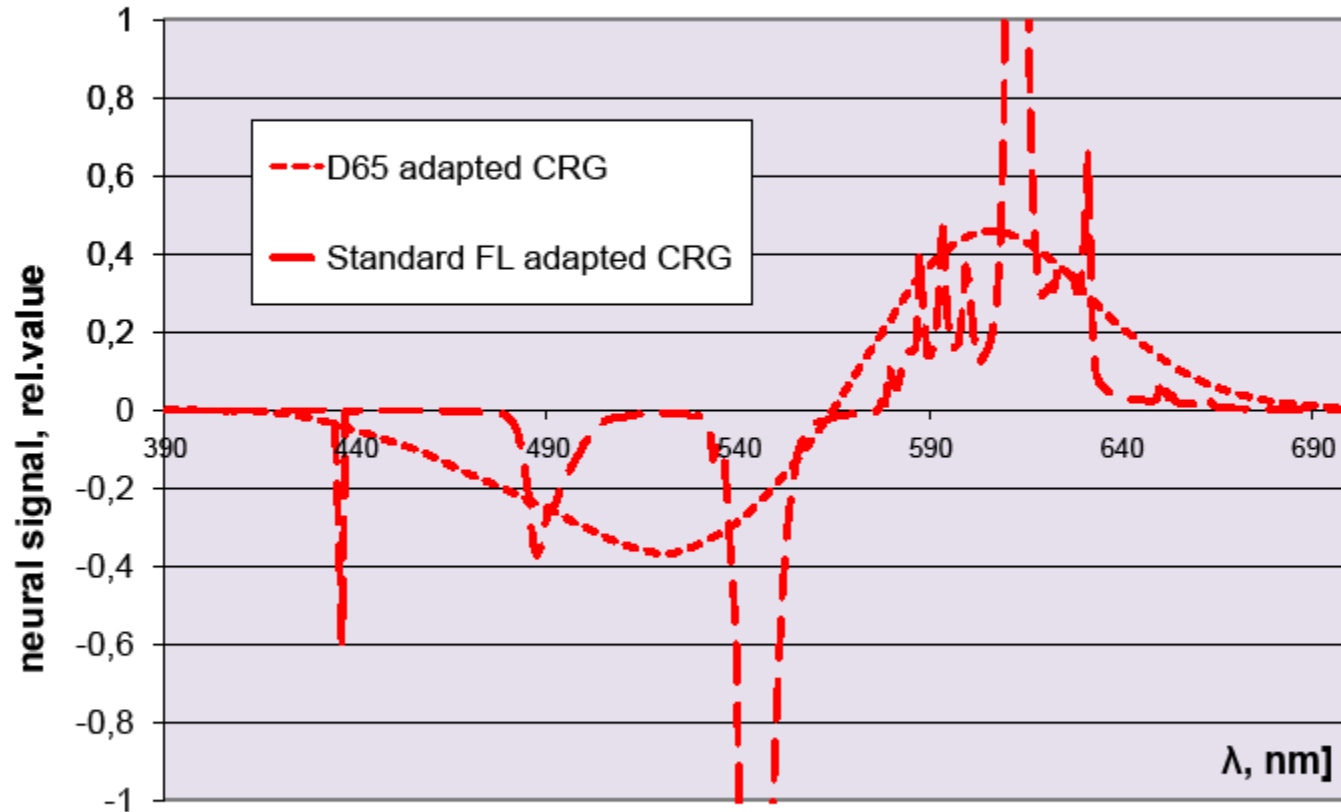
Neural opponent signals



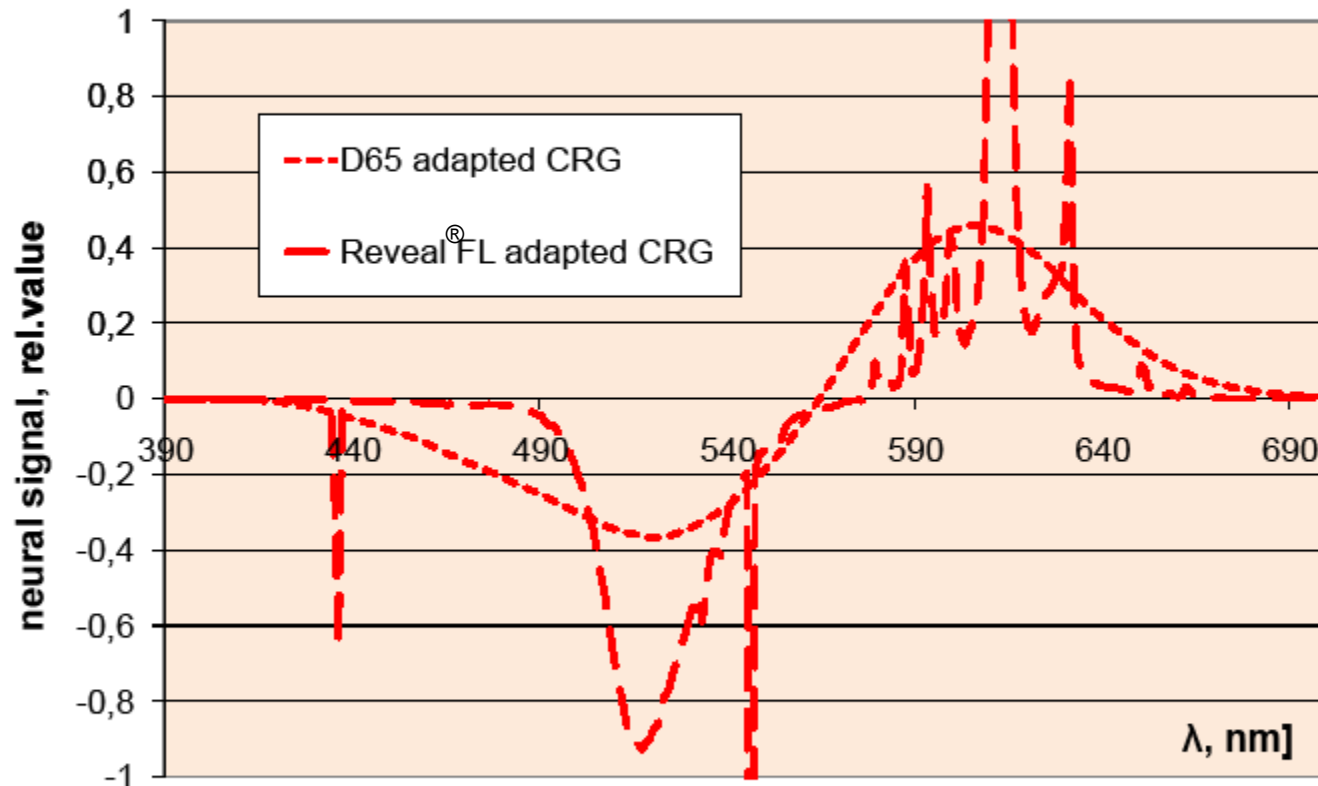
# Emission spectra



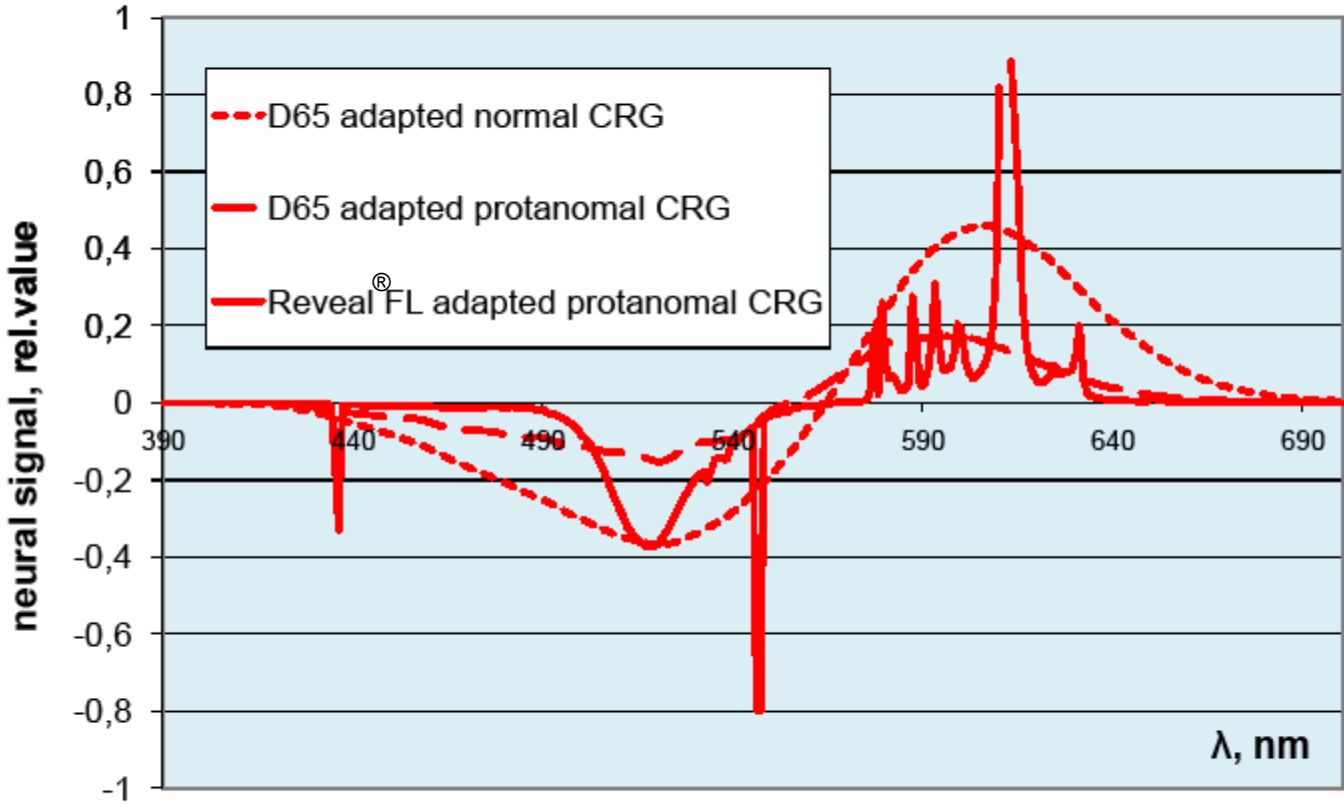
# RG neural opponent signal adapted to standard FL



# RG neural opponent signal adapted to Reveal<sup>®</sup> FL



# Protanomal's RG neural opponent signal adapted to Reveal<sup>®</sup> FL



# Enhanced chroma effects:

- Make colour more vivid: increased chroma
- Improve green-red contrast
- Good for person with colour-deficiency
- Increase perceived illumination level