

IES TM-30-15: Overview and Program Implementation

ENERGY STAR Partners Meeting

October 12-14, 2015

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“Original”



Image courtesy of Randy Burkett Lighting Design

“CRI = 80” Desaturated



Image courtesy of Randy Burkett Lighting Design

“CRI = 80” Saturated



Image courtesy of Randy Burkett Lighting Design

CIE CRI (1965/1974)

IES TM-30-15 (2015)

Fidelity Metric Only



Fidelity, Gamut, Graphical,
Detailed

CIE 1964 $U^*V^*W^*$



CAM02-UCS (CIE CAM02)

8 color samples

Medium chroma/lightness
Spectral sensitivity varies
Munsell samples only



99 color samples

Uniform color space coverage
Spectral sensitivity neutral
Variety of real objects

Ref Illuminant Step Function



Ref Illuminant Continuous

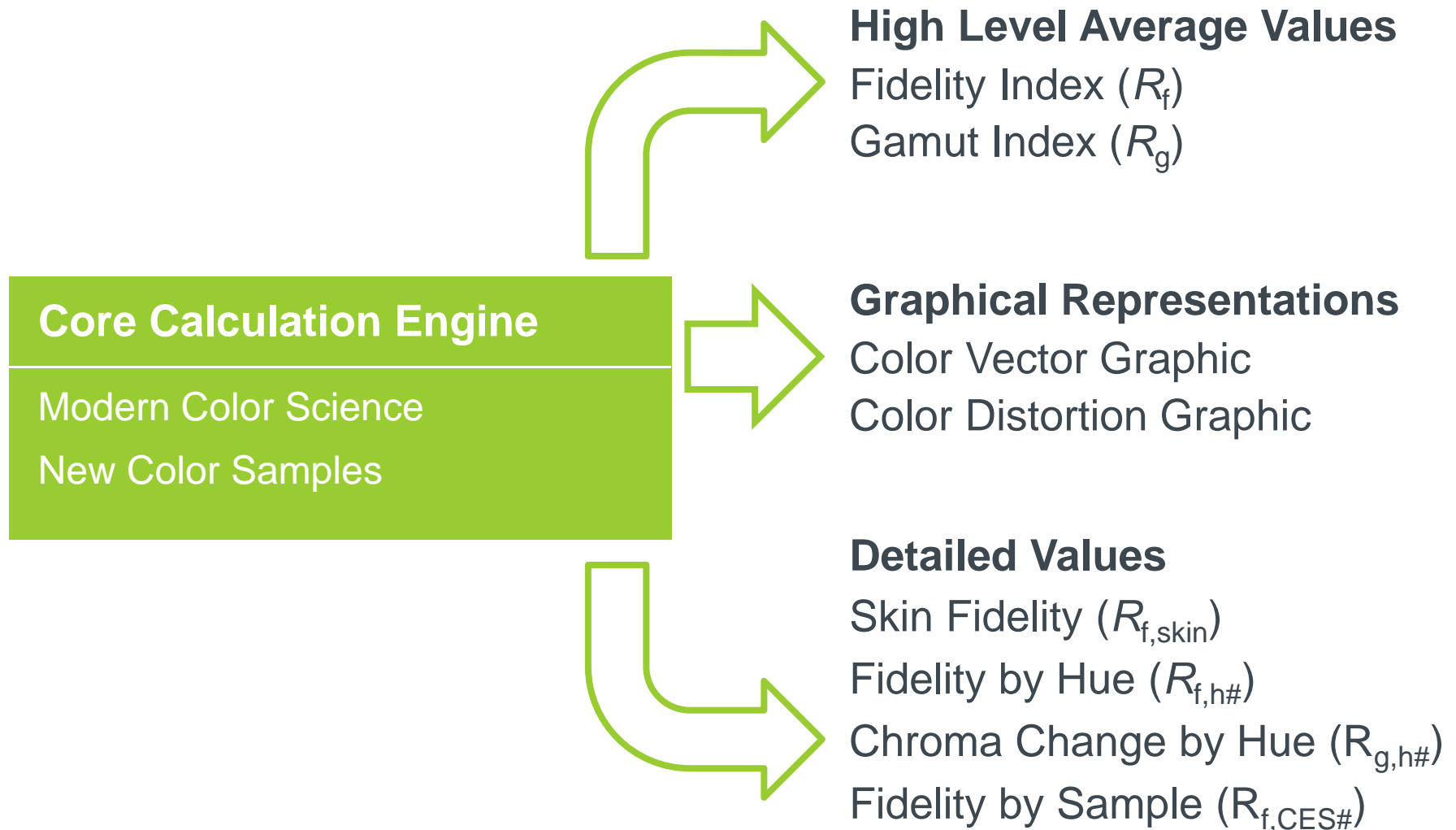
(Uses same reference sources, but blended
between 4500 K and 5500 K)

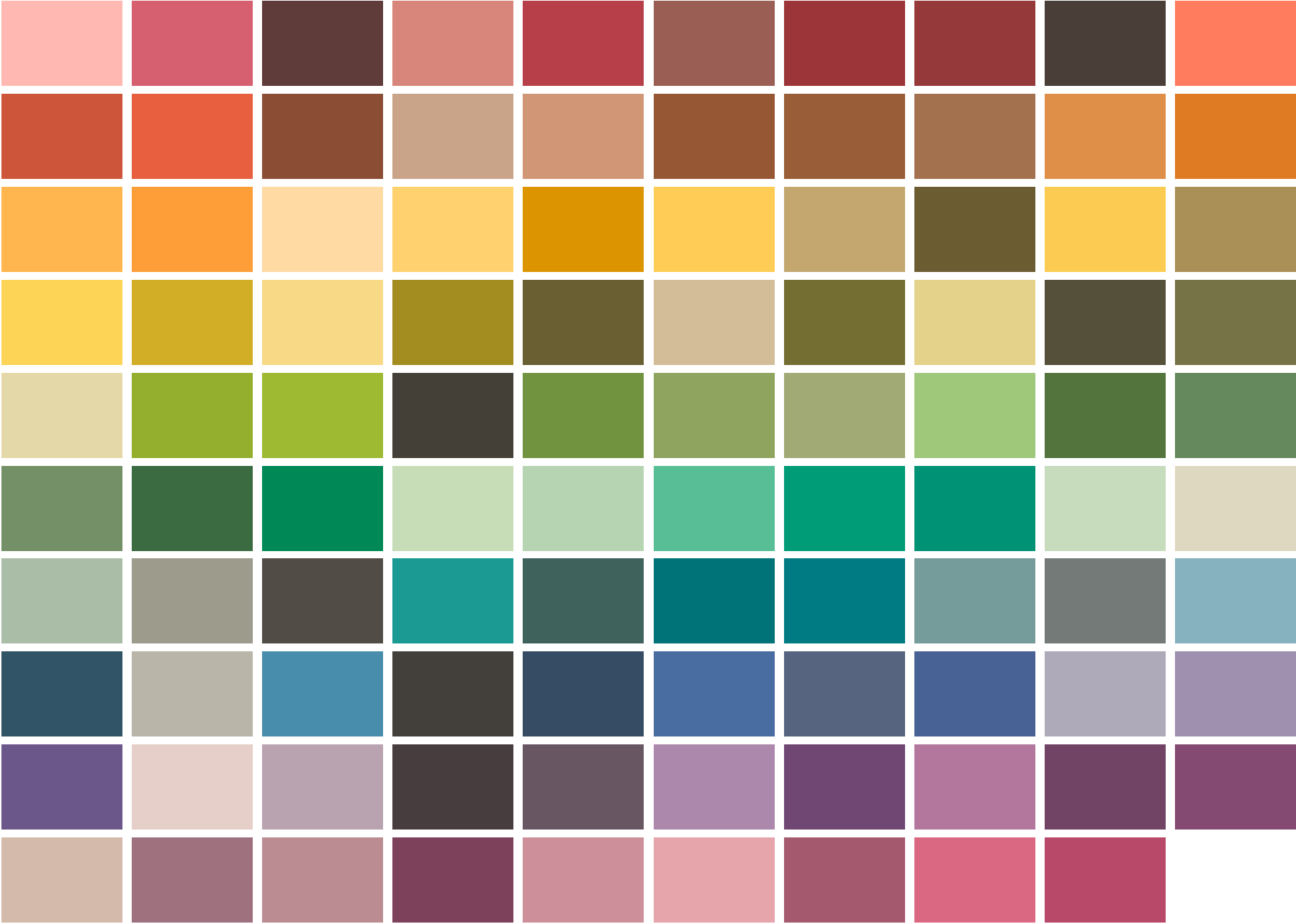
No lower limit for scores
and inconsistent scales



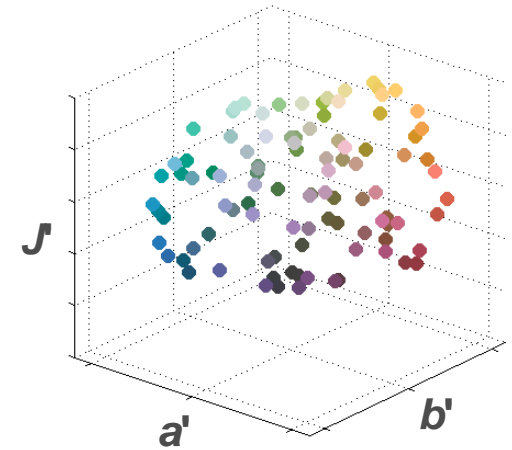
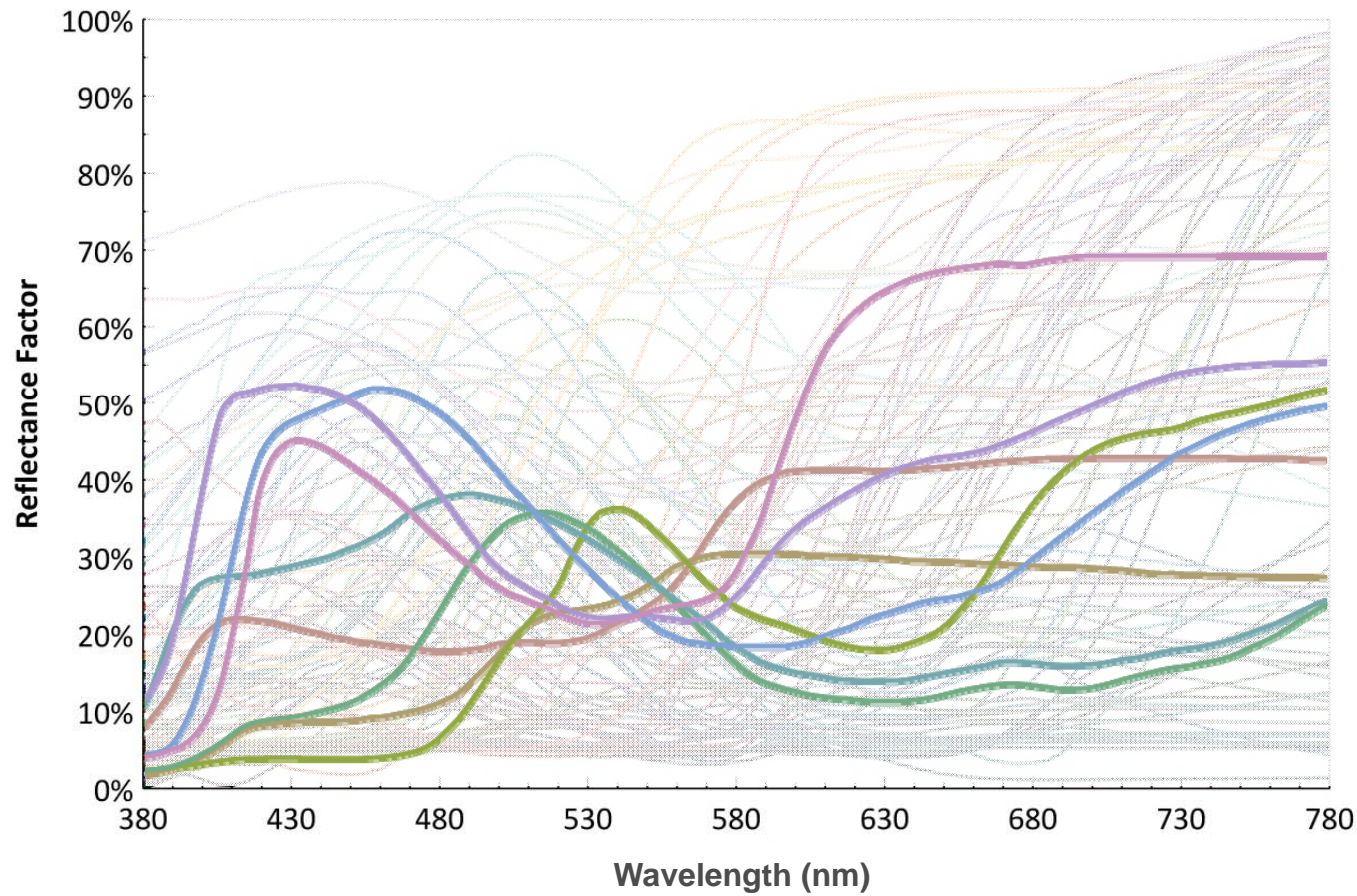
0 to 100 scale (fidelity)

IES TM-30-15 Method

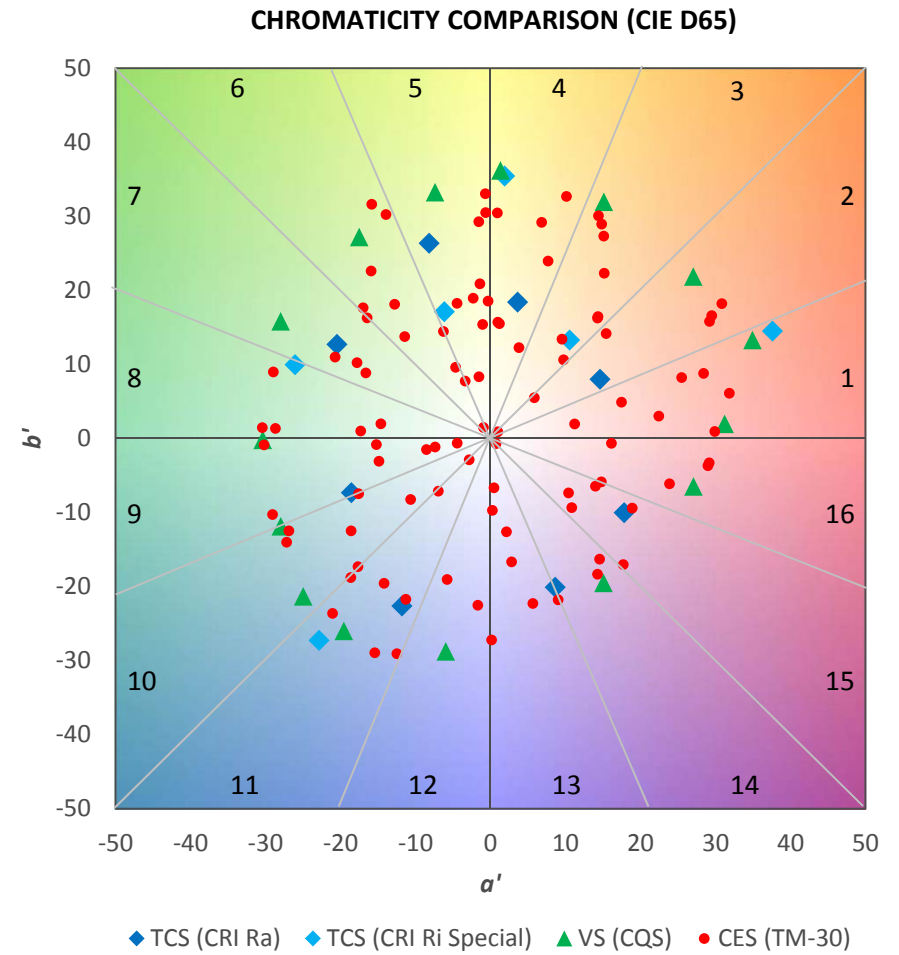
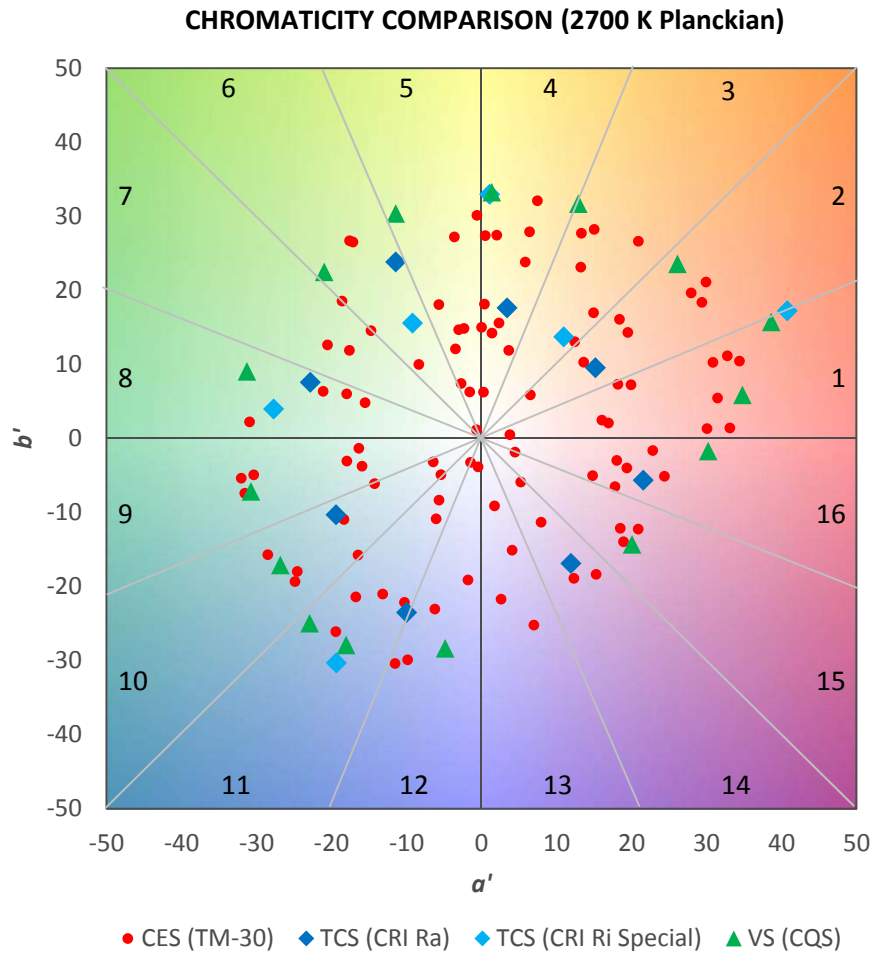




TM-30-15 Color Evaluation Samples (CES)

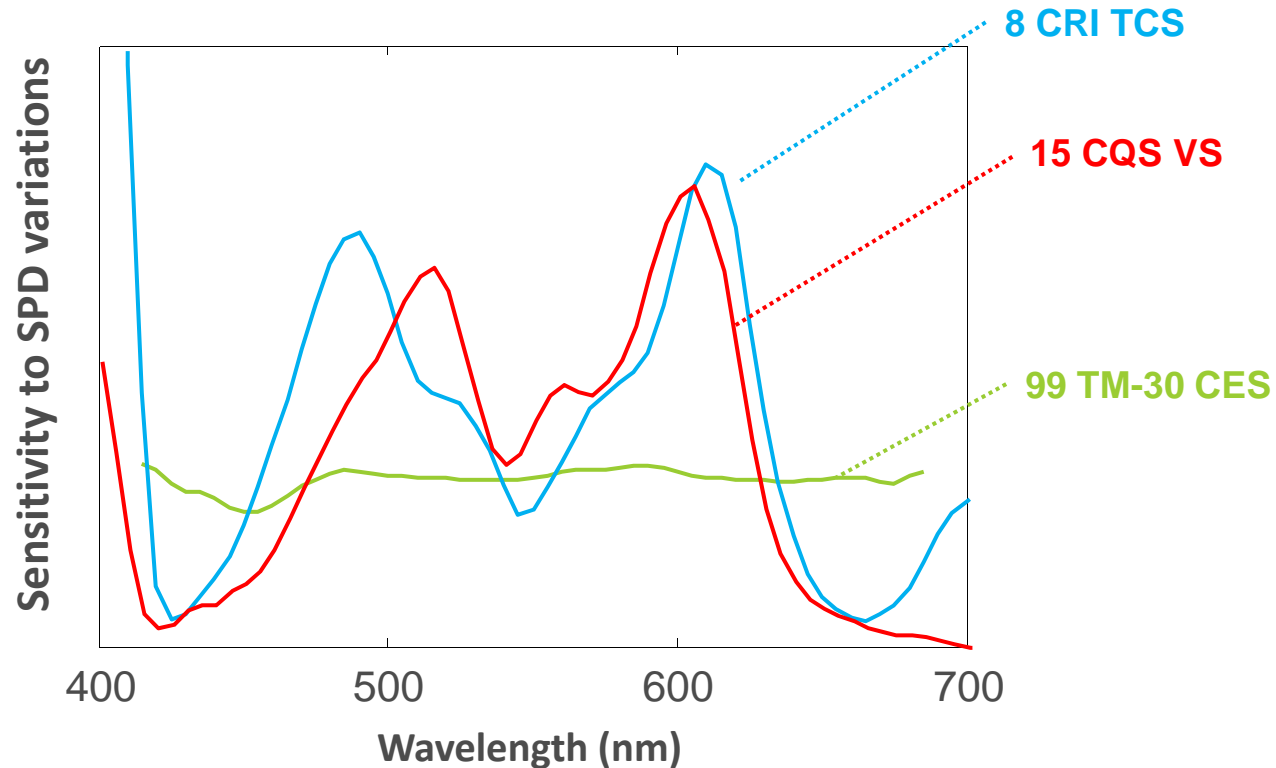


TM-30 Color Evaluation Samples (CES)



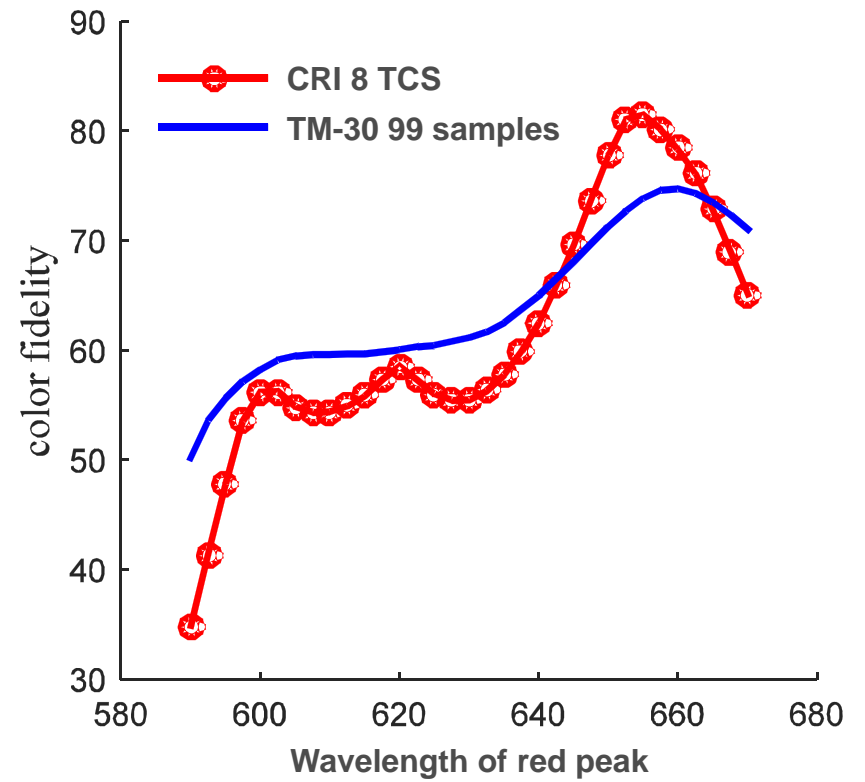
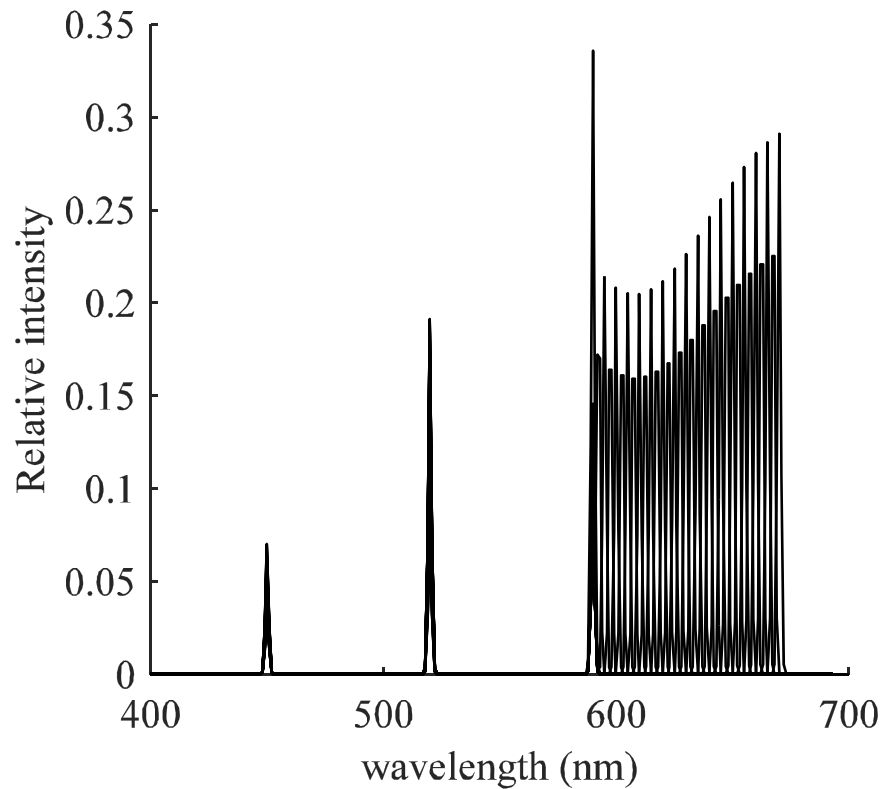
The samples cover the area of all 14 CRI samples, as well as the area of the CQS samples. [Note charts only two dimensional representation]

TM-30-15 CES Wavelength Uniformity



$$F = k_1 \int |(r')^2 - \langle (r')^2 \rangle| d\lambda + k_2 \int |(r'')^2 - \langle (r'')^2 \rangle| d\lambda$$

Effect of Wavelength Uniformity



The artificial sensitivity of the CRI TCS is removed with TM-30 samples

IES Method for Color Rendition

Color Fidelity

The accurate rendition of color so that they appear as they would under familiar (reference) illuminants

Fidelity Index (R_f)
(0-100)

Color Gamut

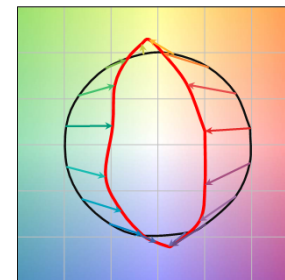
The average level of saturation relative to familiar (reference) illuminants.

Gamut Index (R_g)
~60-140 when $R_f > 60$

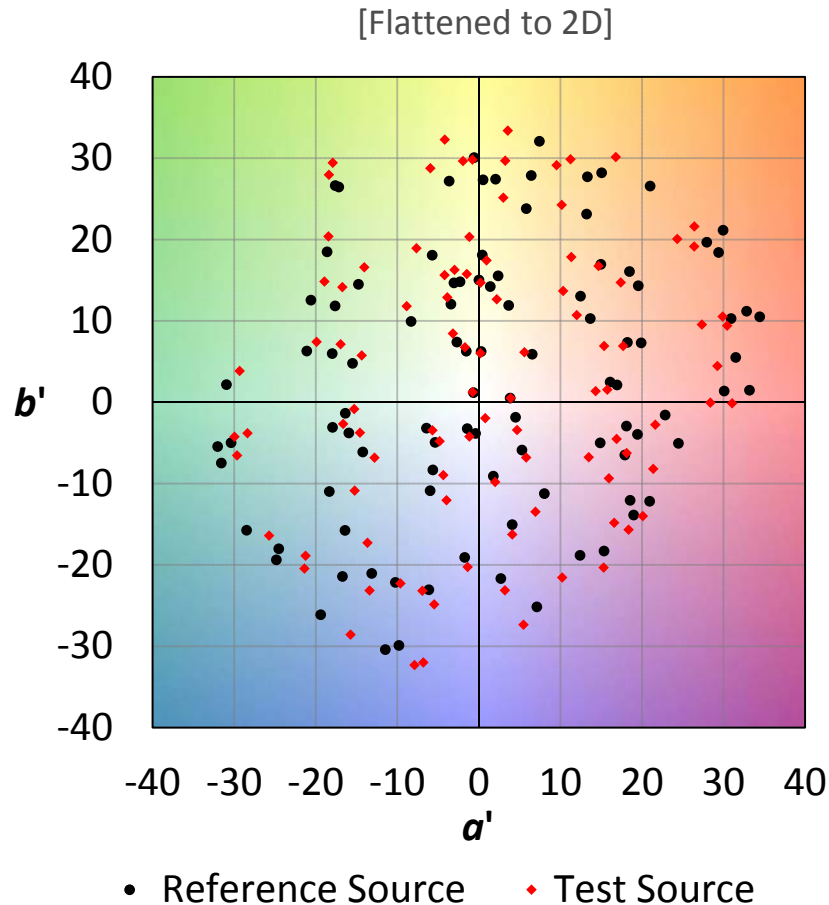
Graphics

Visual description of hue and saturation changes.

Color Vector Graphic

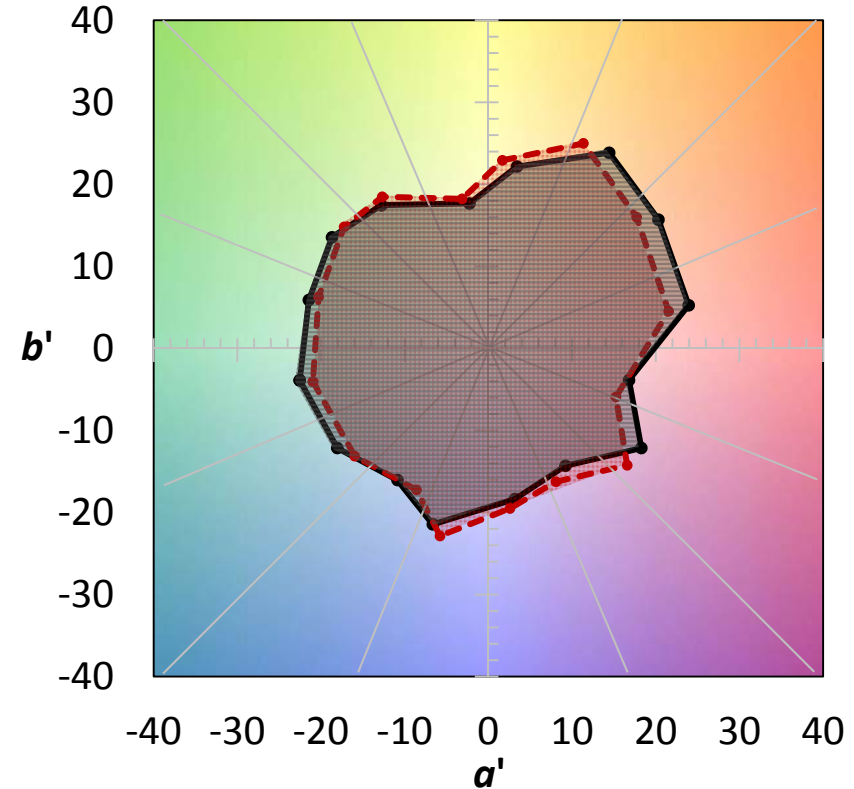
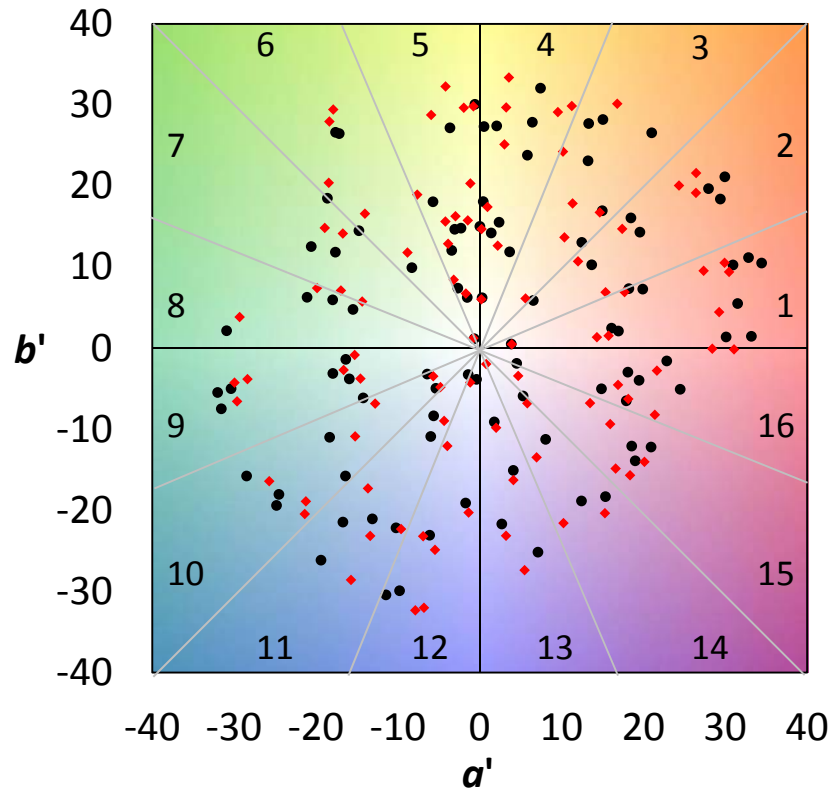


Fidelity Index: R_f



- Average similarity in appearance of test and reference sources
- Analogous to CIE R_a , greater accuracy
- Scores 0 to 100
- Scale similar to CIE R_a , but a tougher test
- Equal weight to all directions of shift
- Most important when trying to match the look of the reference source
- Perfect fidelity does not always mean the perfect source for the application

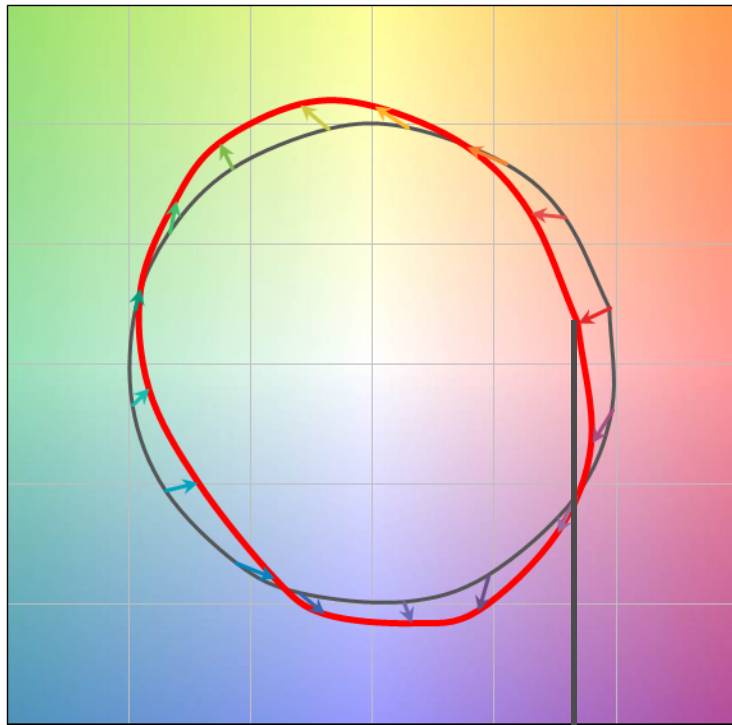
Relative Gamut Index: R_g



- An R_g value greater than 100 indicates an average increase in saturation and an R_g value less than 100 indicates an average decrease in saturation.
- Range of about ~ 60 -140 when $R_f > 60$

Color Vector Graphic

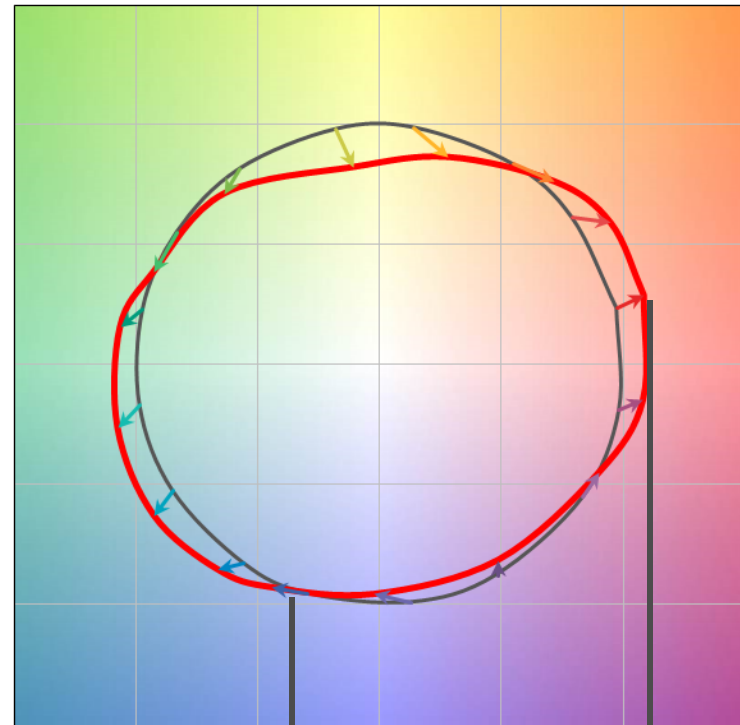
$R_f = 75$ | $R_g = 100$ | CCT = 3500 K



— Test Source
— Reference

Decreased Saturation

$R_f = 75$ | $R_g = 100$ | CCT = 3500 K



Hue Shift

Increased Saturation

[Theoretical]



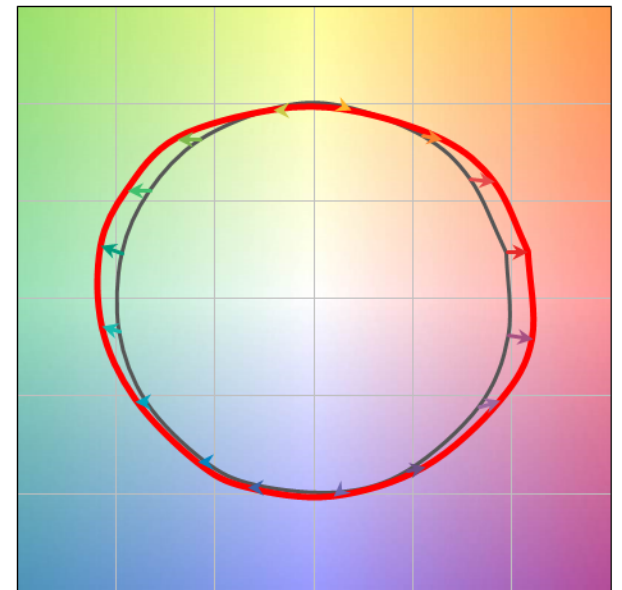
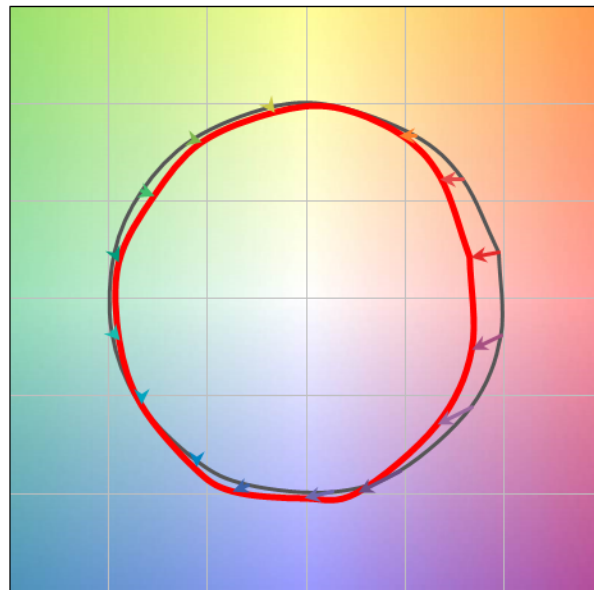
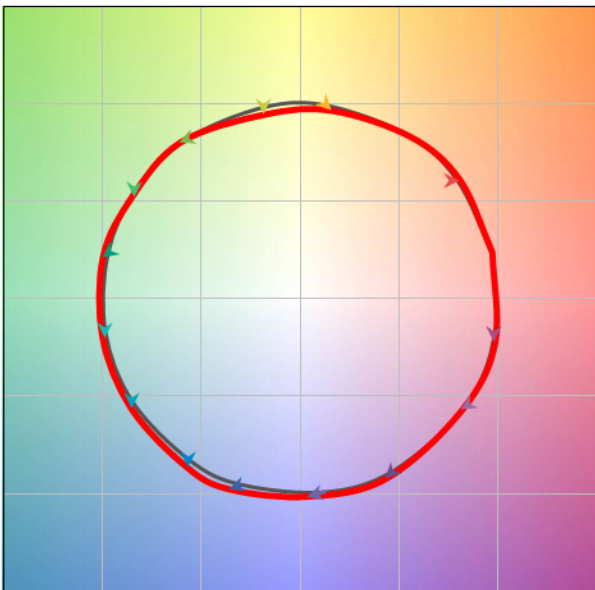
Original



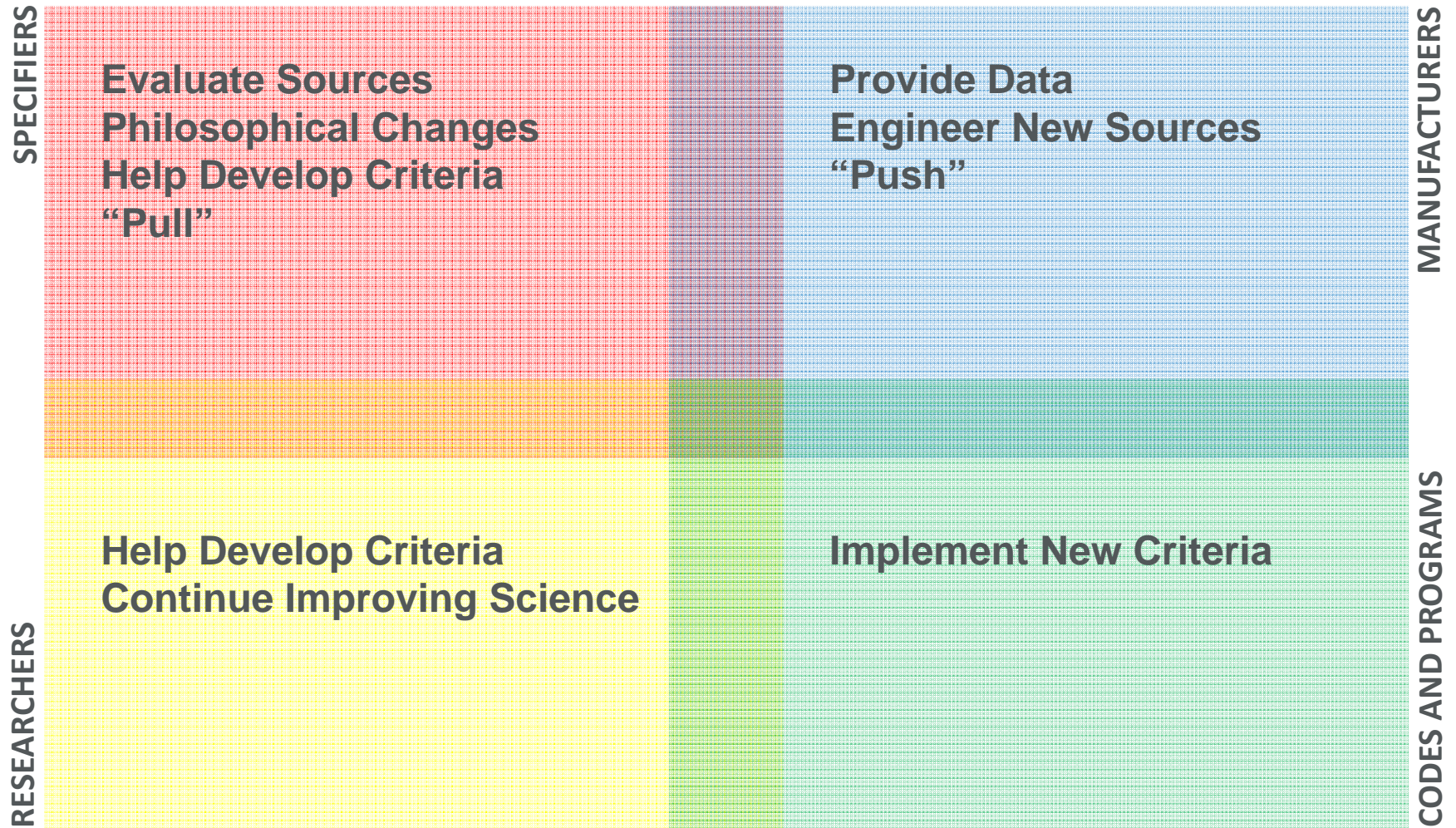
Desaturated



Red-Enhanced



TM-30-15 Adoption



Which Product is Better?

Measure	Scale	Comparisons
CRI R_a	? – 100	Higher is "better"
TM-30 R_f	0 – 100	Higher is "better"
TM-30 R_g	60 – 140 (Approx.)	Varies
TM-30 Icon	None (Visual)	Varies

Which Product is Better?

Preliminary experimental data from one space.



More Liked



Less Liked