



spectral optimization +  
spatial control =  
more than the sum

Wendy Davis & Dorukalp Durmus

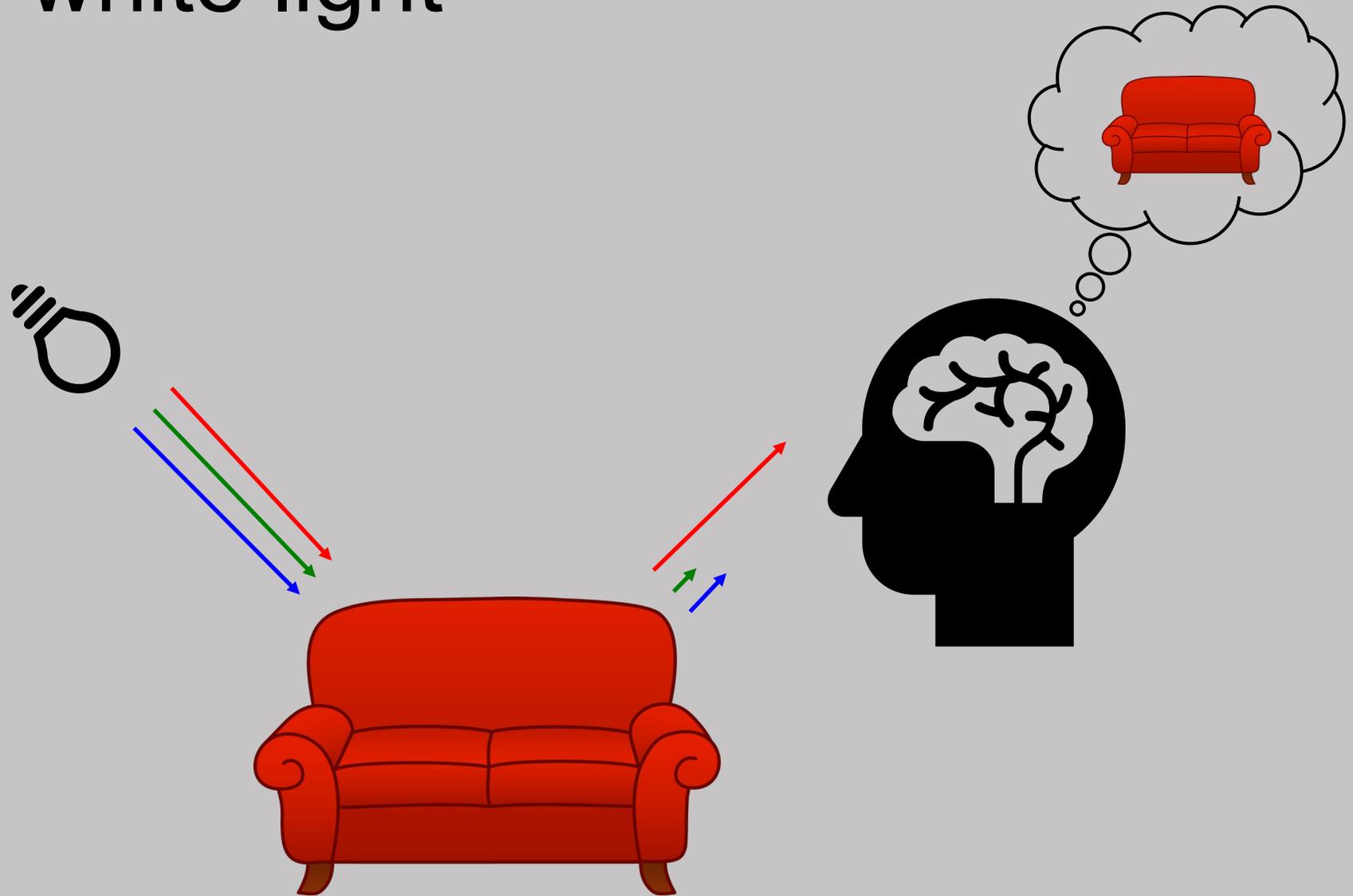
Photo by Efe Kurnaz on Unsplash

Can we do better?

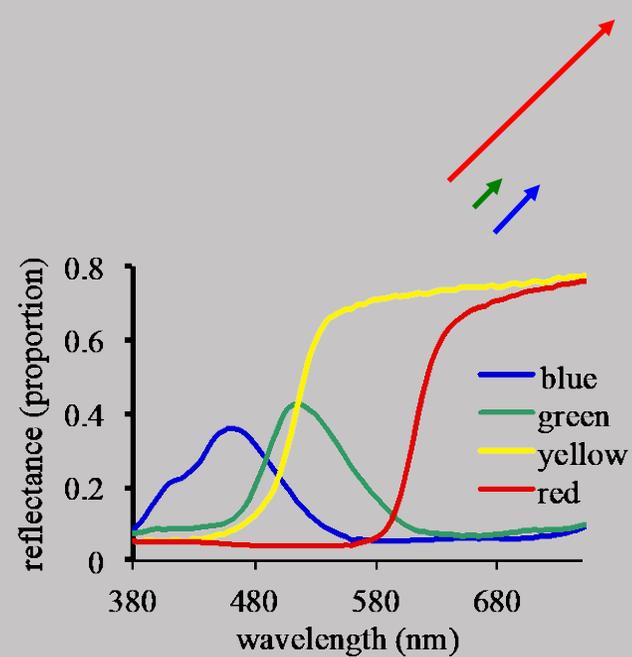
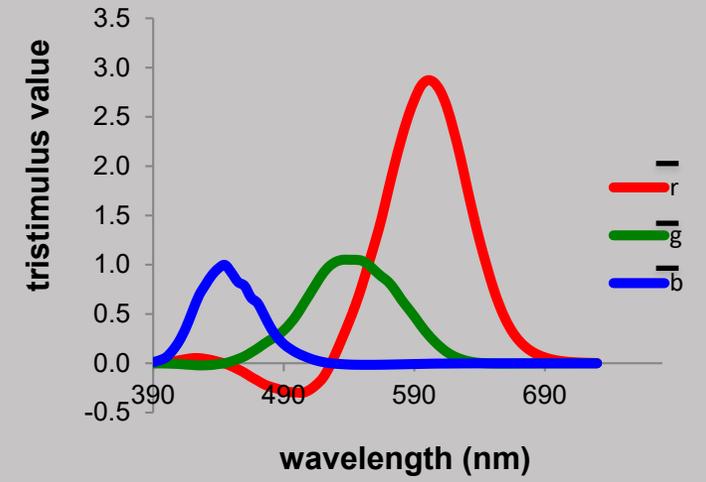
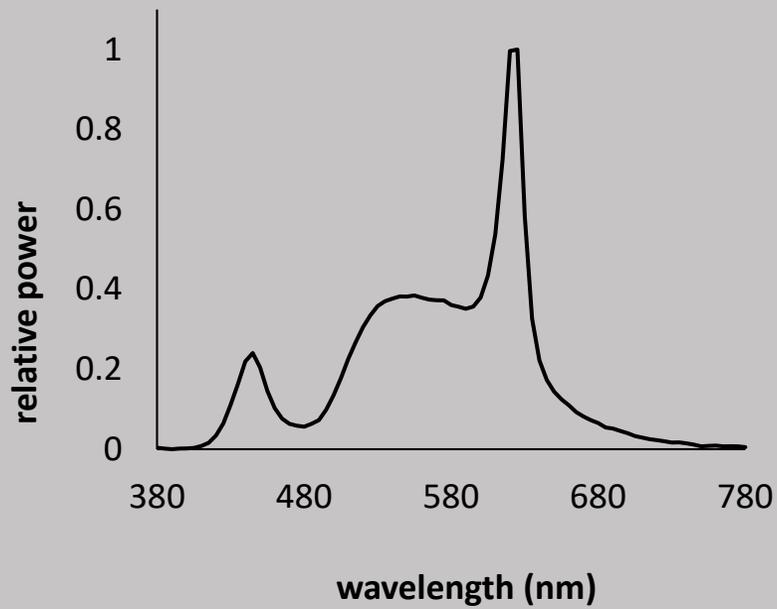
“LED light bulb” by Karl Baron / CC BY 2.0



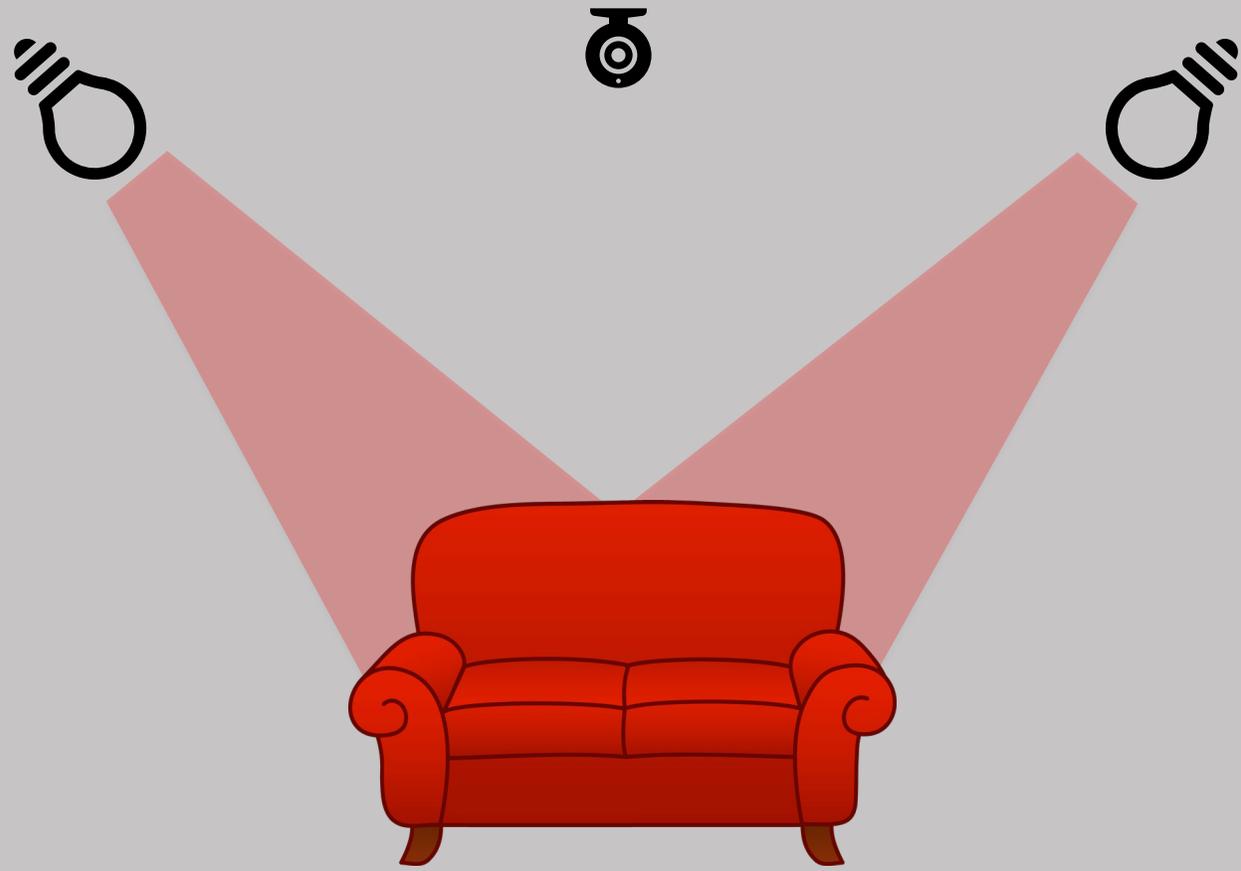
# Rethinking white light



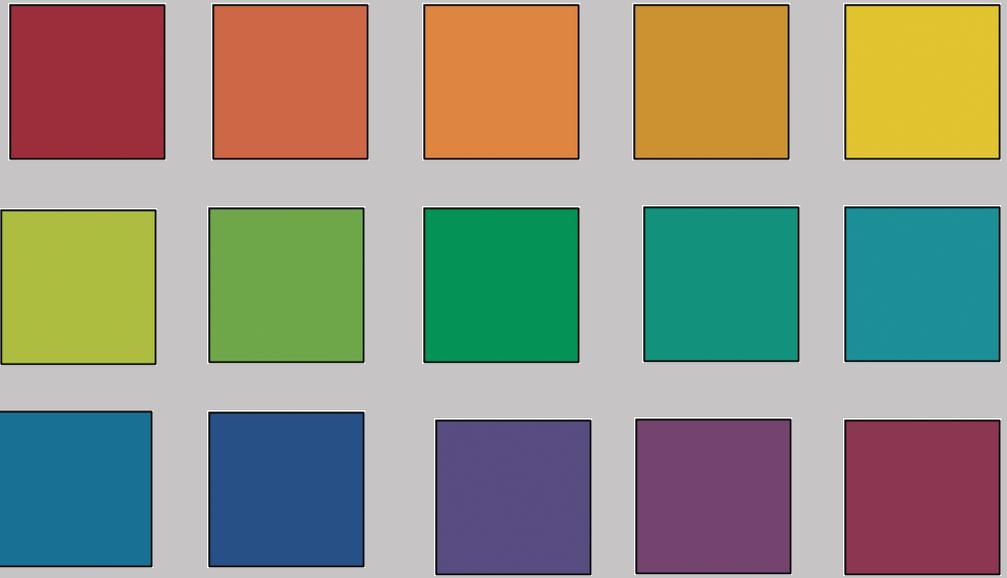
# Rethinking white light



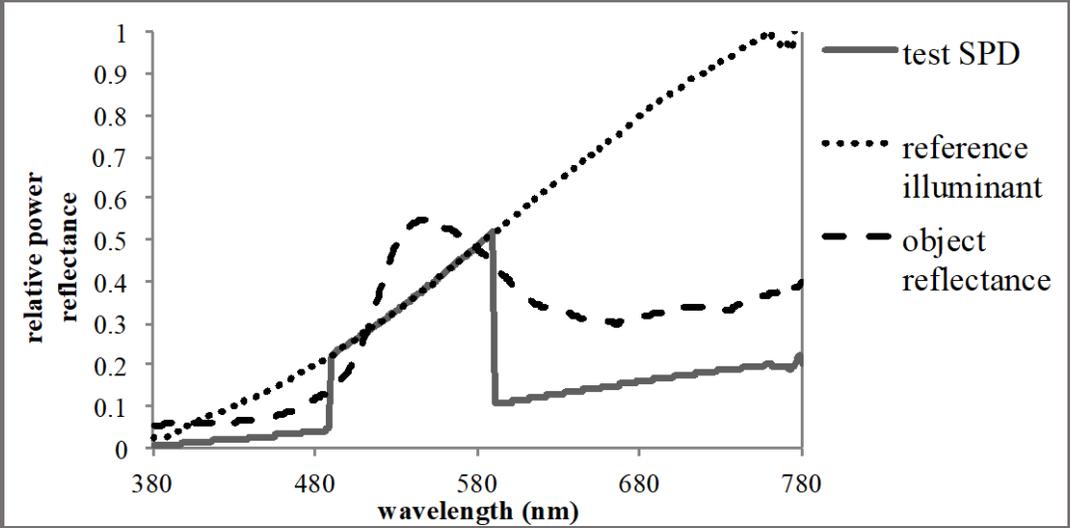
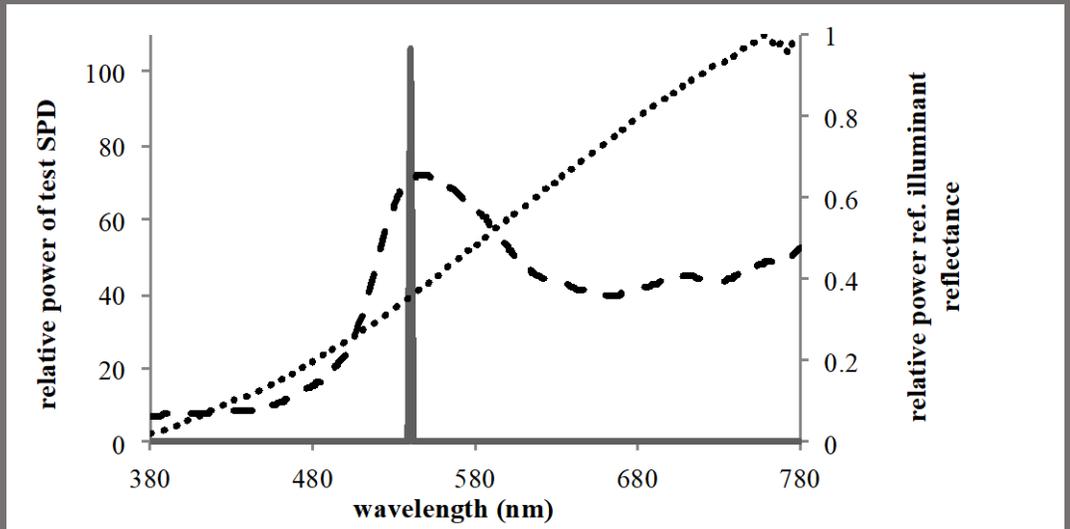
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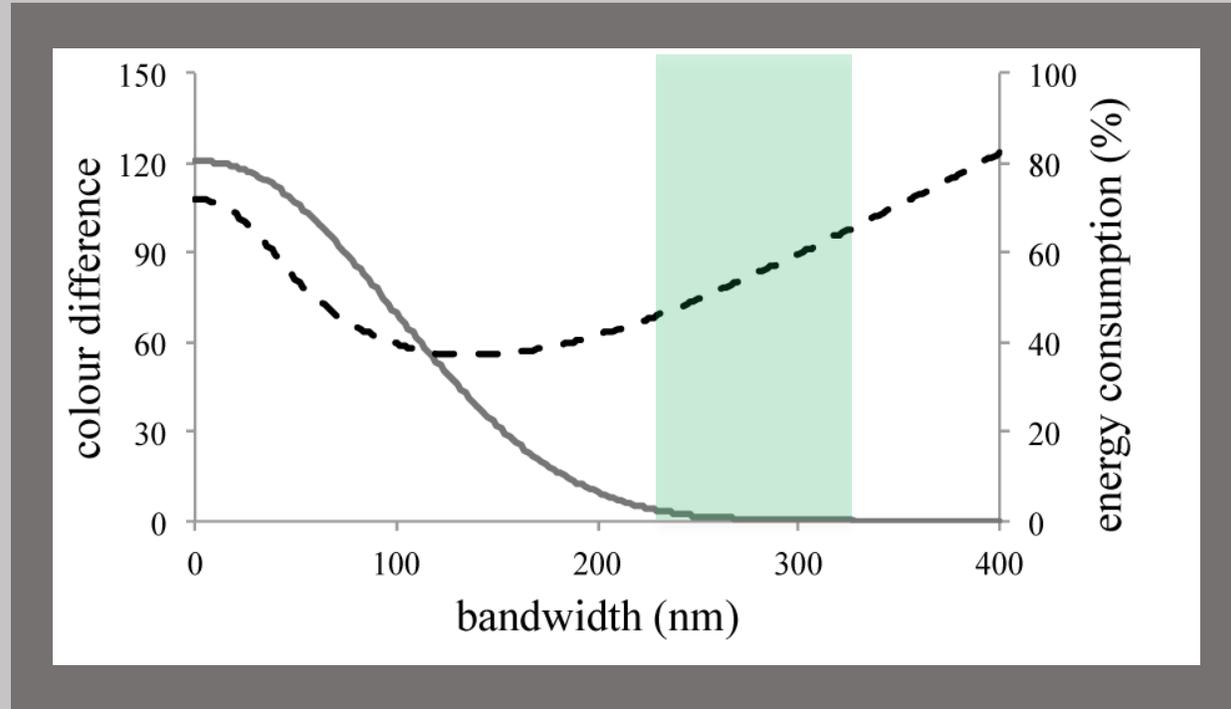
# Spectral optimization



Example: yellow surface color



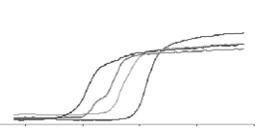
# Initial optimizations



Example: orange surface color  
center wavelength = 544 nm

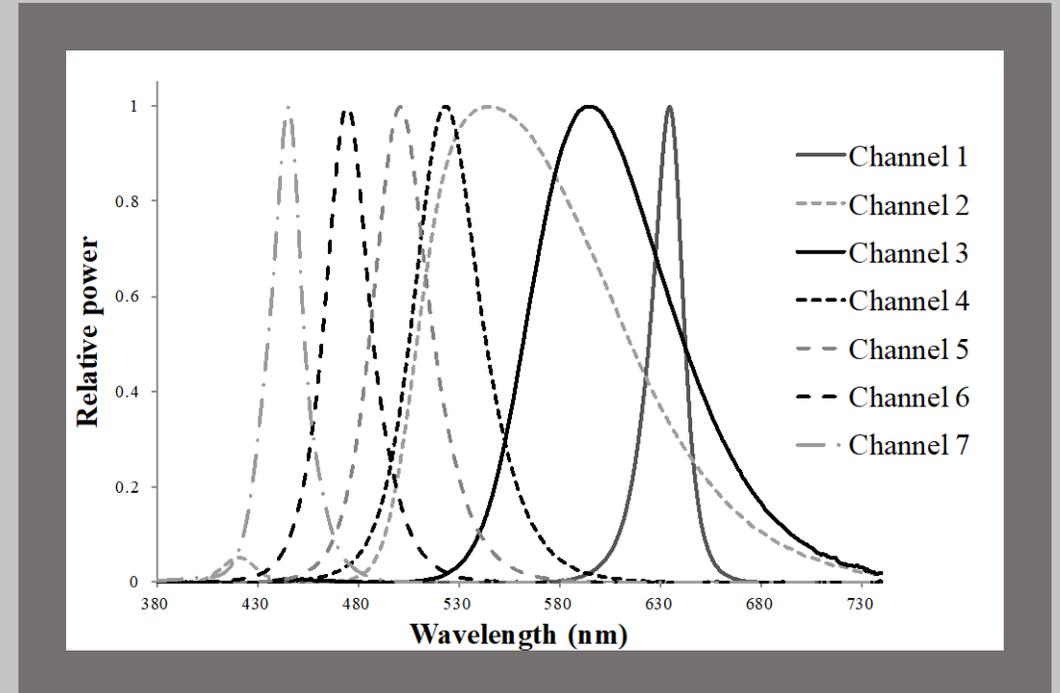
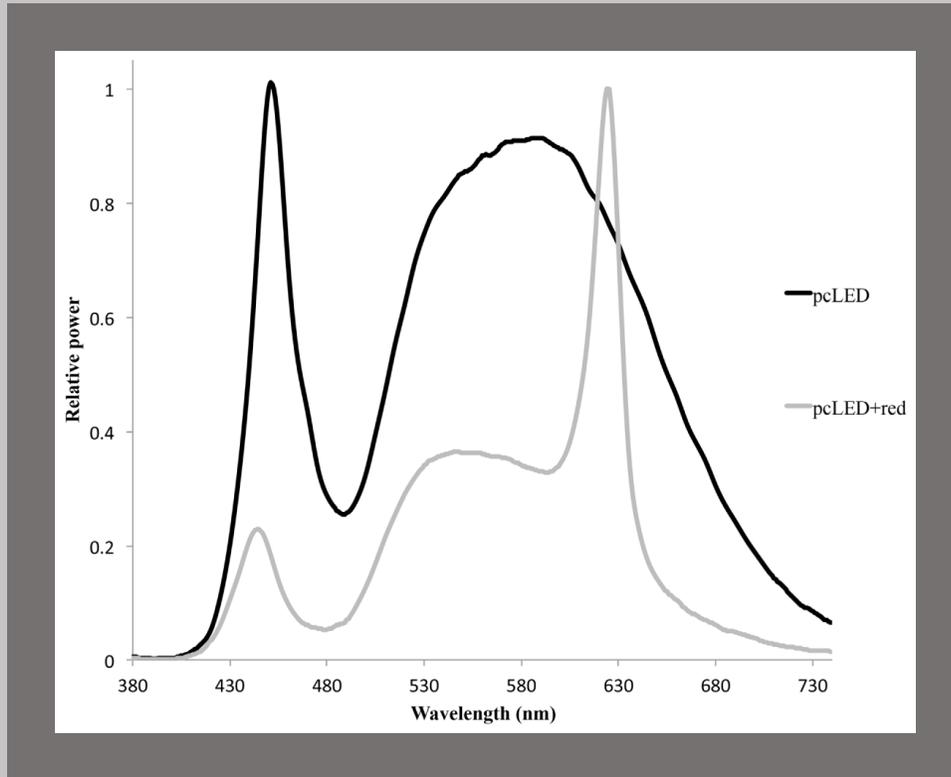
Durmus, D., & Davis, W. (2015). Optimising light source spectrum for object reflectance. *Optics Express*, 23(11), A456-A464.

# Initial optimizations

	Object Reflectance Type	CQS Sample	Starting Point (nm)	Bandwidth (nm)	Baseline	Max. Energy Saving (%)
	Plateau	S1, S2, S3, S4	548	265	0.0	40
	Peak + Plateau	S5, S6	544	262	0.0	42
	Peak	S7, S8	538	261	0.0	44
	Peak + Incline	S9, S10, S11, S12	537	260	0.0	44
	Plateau + Peak	S13, S14, S15	547	275	0.0	38

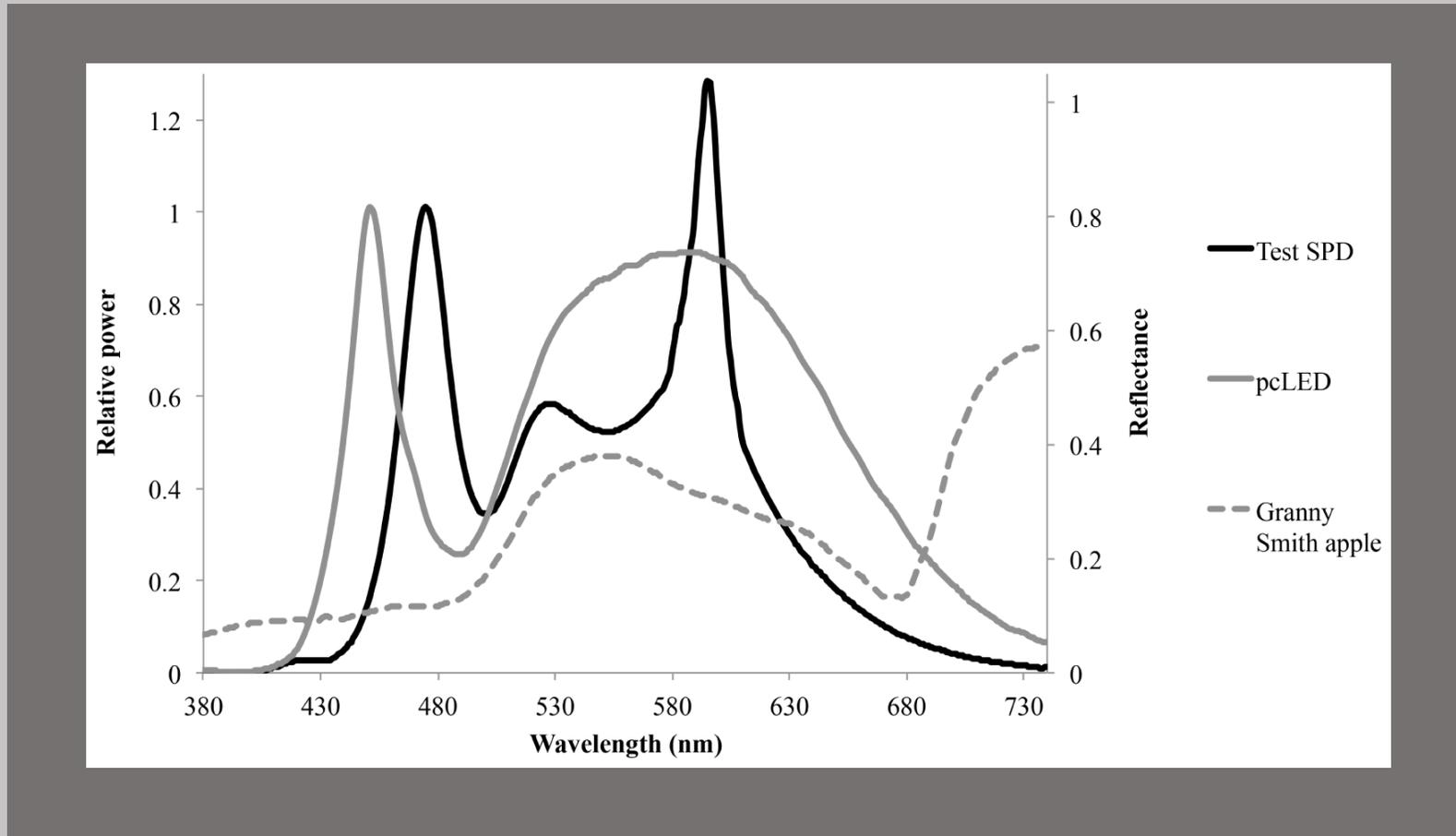
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# Real-world feasibility



Durmus, D., & Davis, W. (2017). Object color naturalness and attractiveness with spectrally optimized illumination. *Optics Express*, 25, 12839-12850.

# Real-world feasibility



Example: 8% energy savings

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# Real-world feasibility

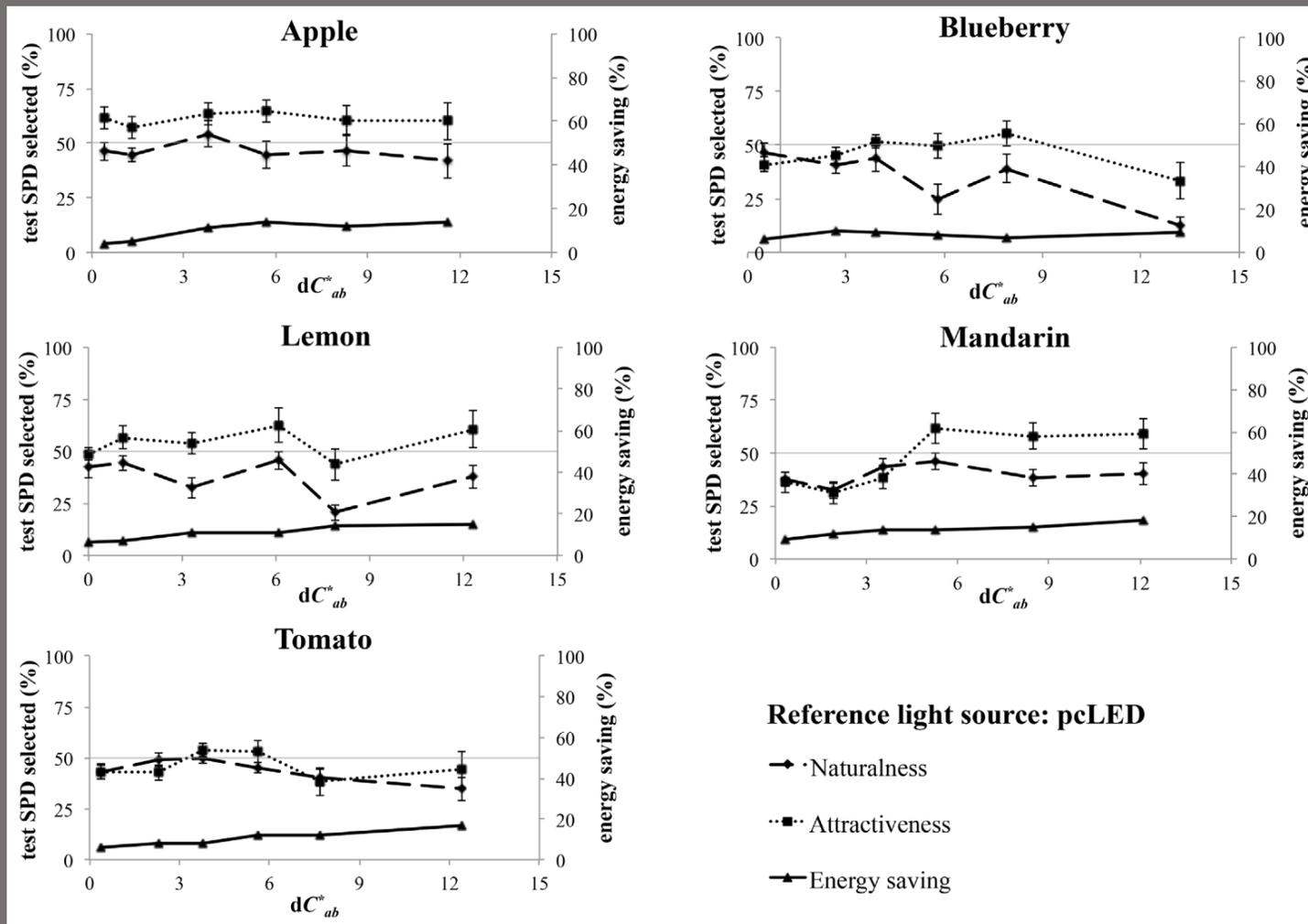
	Energy Savings (%) $\Delta E_{ab}^* < 1.0$		Energy Savings (%) $\Delta E_{ab}^* < 5$	
	pcLED	pcLED+red	pcLED	pcLED+red
Coca-Cola can	11	2	17	9
Tomato	13	6	16	9
Mandarin	13	4	19	10
Carrot	14	4	19	9
3M Post-it	13	8	15	9
Lemon	14	10	17	16
Lime	13	15	18	15
Granny Smith apple	15	10	17	13
Nivea Creme container	14	10	14	13
Blueberry	15	14	16	15

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# Questions? Comments? Ideas?

