Figures for “Applications of Vectorial Color”

James A. Worthey, 2009

Captions are reproduced here for convenience. The ms has a normal caption list.

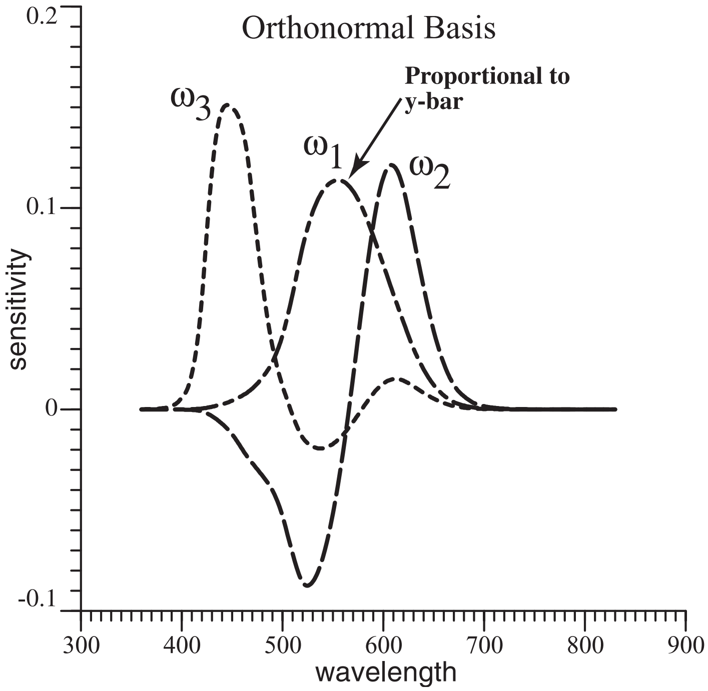

Fig. 1. The functions of the orthonormal basis.

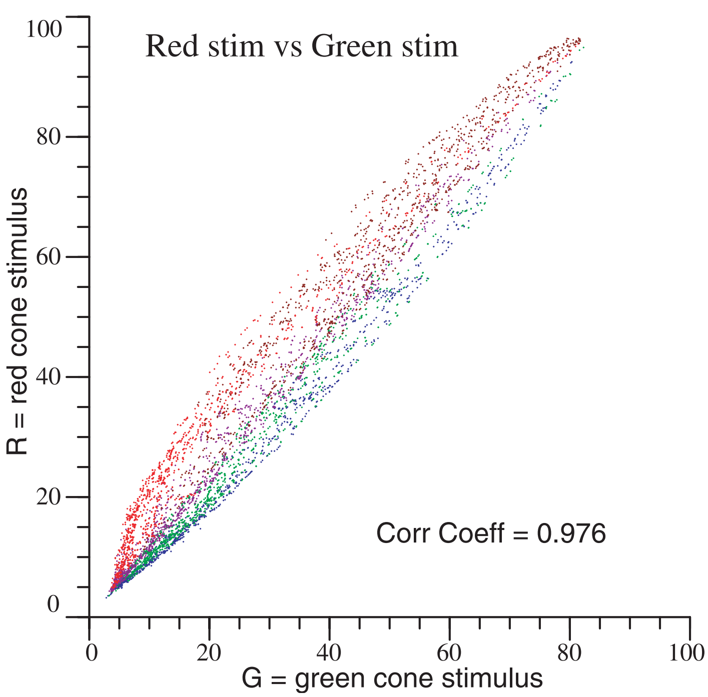

Fig. 2. Cone stimuli, red versus green. Each dot is a paint chip lit by D65.

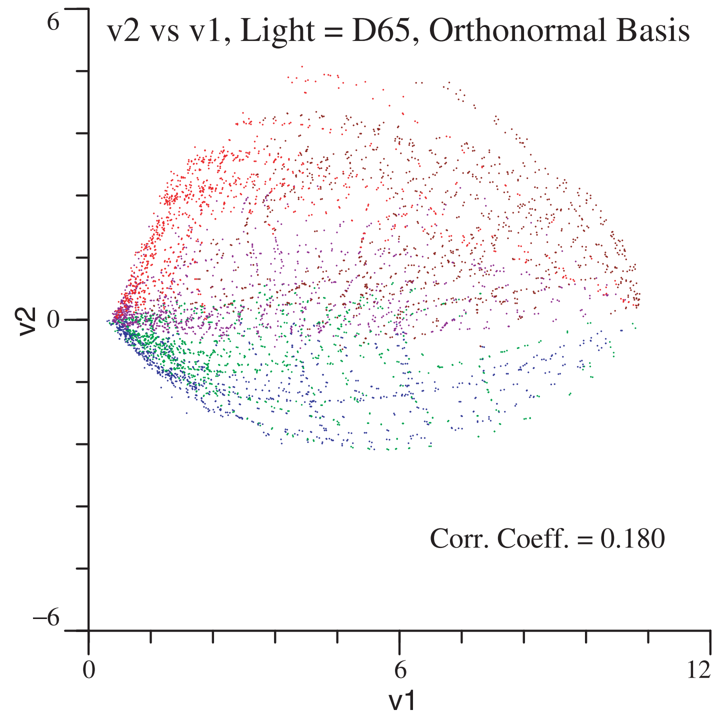

Fig. 3. Dots are the same paint chips under D65. Stimuli are now expressed as v_2 versus v_1 based on Eq. (3).

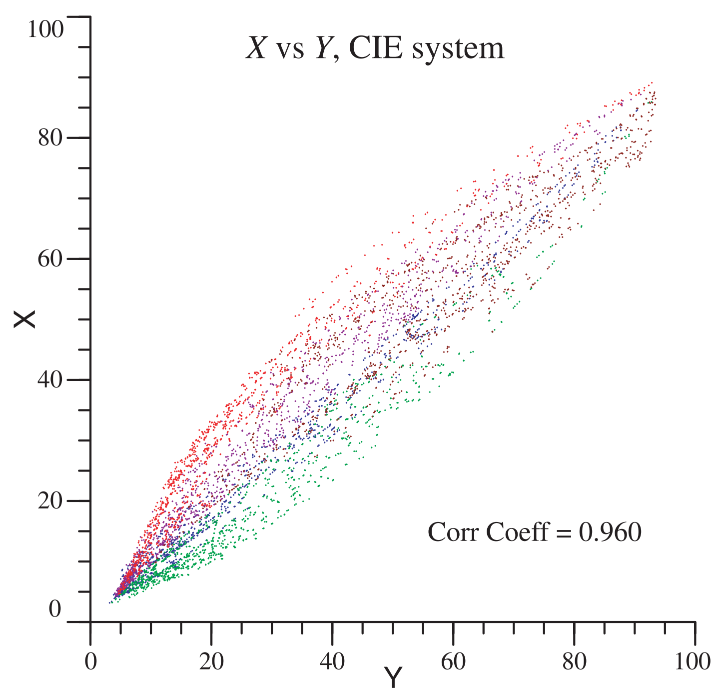

Fig. 4. Dots are the same paint chips under D65. Stimuli are now expressed as *X* versus *Y*, in the usual CIE system.

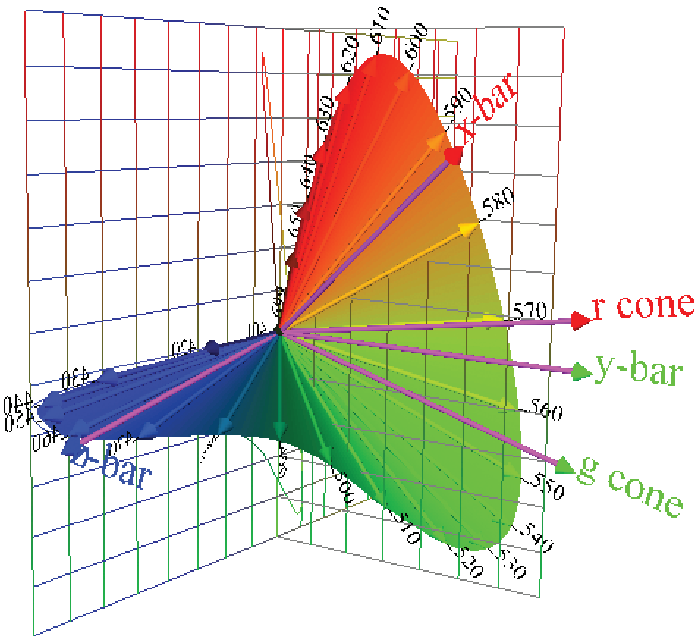

Fig. 5. Color matching functions as directions in color space. The functions ω_1, ω_2 , and ω_3 plot to the v_1, v_2, v_3 axes, which are achromatic (to the right, equal to), red-green (upward) , and blue-yellow (near to blue cones).

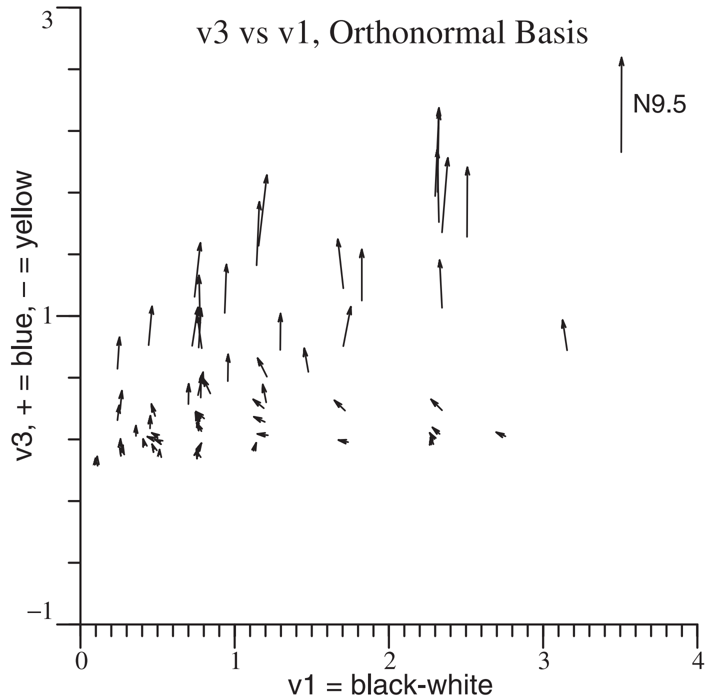

Fig. 7. Similar to Fig. 6, but now v_3 is plotted versus v_1.

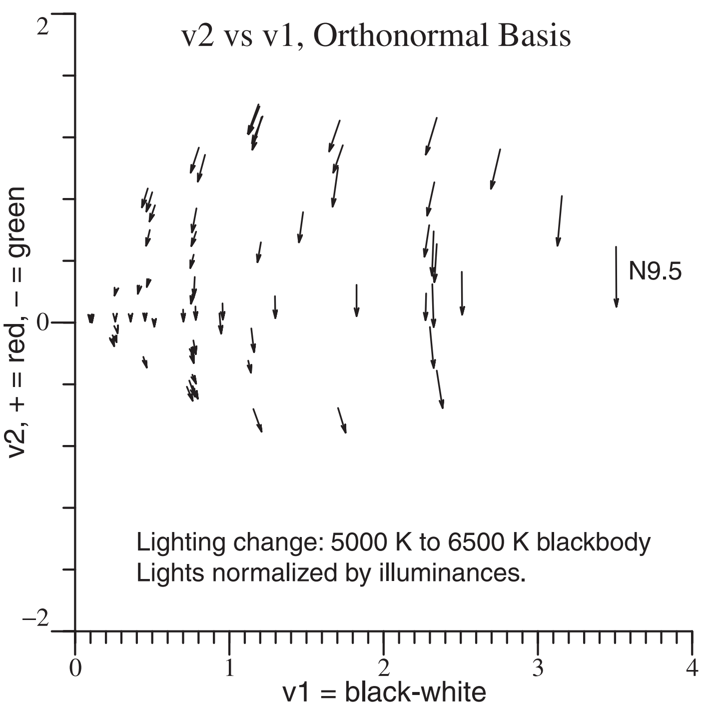

Fig. 6. Each arrow shows the stimuli from one color chip under blackbody lights, 5000 K at the tail, then 6500 K. Neutral chip N9.5 is a proxy for the lights, which have equal illuminance. Tristimulus vectors are projected into the v_1-v_2 plane.

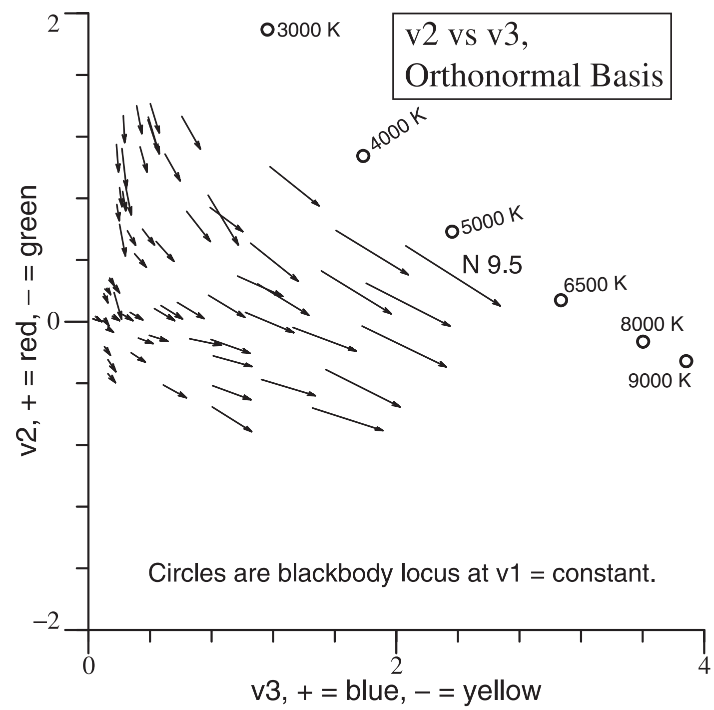

Fig. 8. Similar to Figs. 6 and 7, but now v_2 is plotted versus v_3. Labeled circles are a blackbody locus at v_1 = constant.

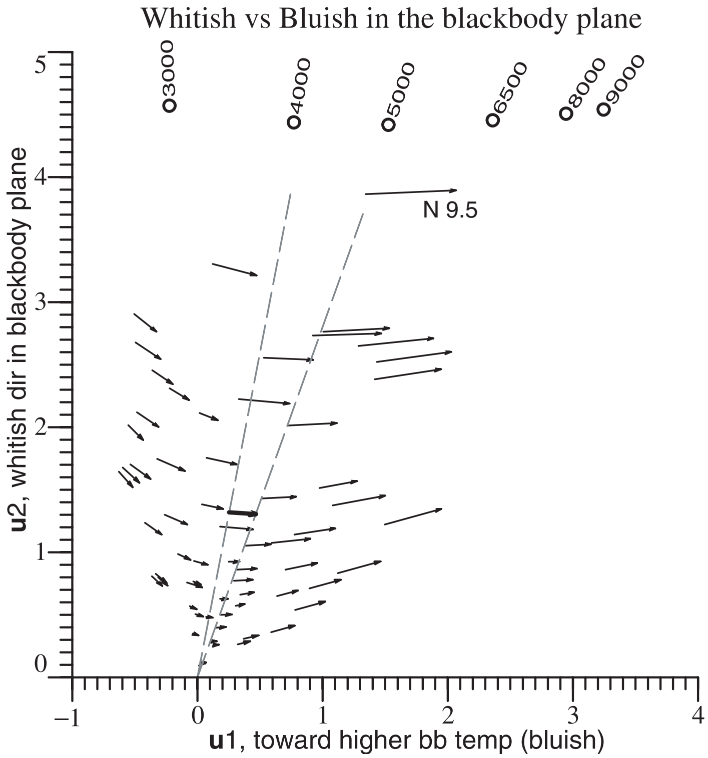

Fig. 9. The same chips are plotted in the same color space as Figs. 6-8. Now the stimuli have been projected into a blackbody plane, as defined in the text. Again, a blackbody locus is indicated.

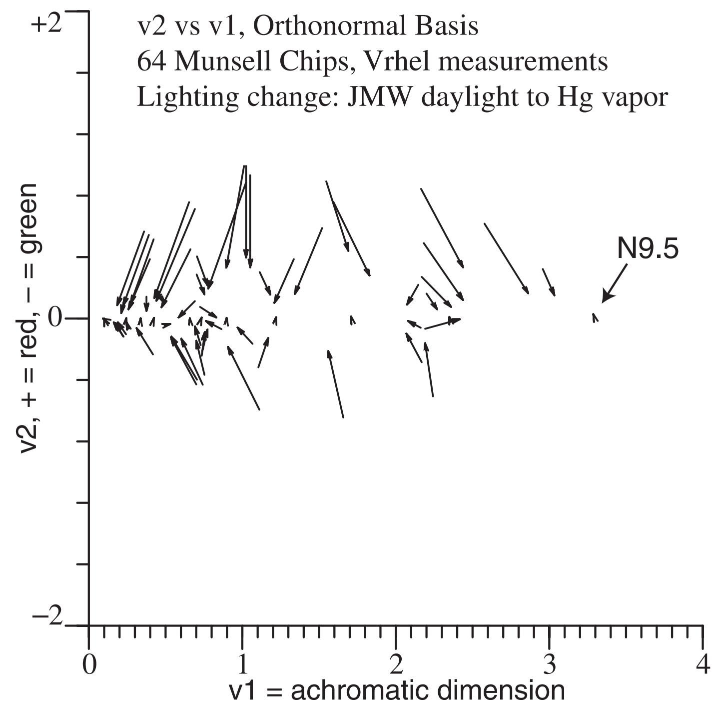

Fig. 11. The same color chips are plotted as in Figs 6-9, but now the lighting transition is from daylight to high-pressure mercury vapor, the lights compared in Fig. 10. This projection shows the loss of red-green contrast.

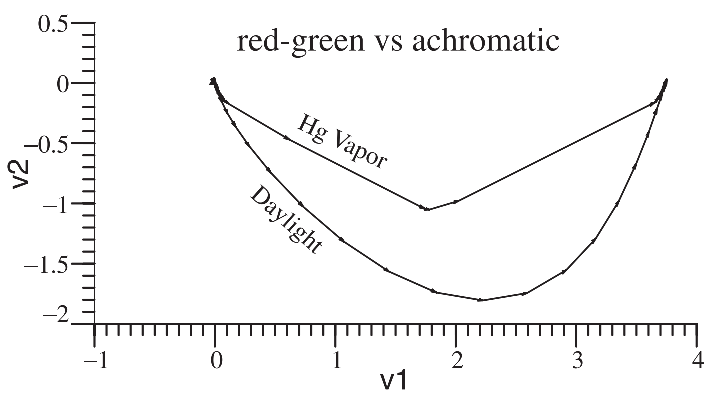

Fig. 10. Two metameric white lights, JMW daylight and mercury vapor, are compared in their vectorial composition. The vectors are projected into v_2 versus v_1. The mercury vapor light takes a shortcut from blue to white, with less of a swing towards green (downward) and back towards red.

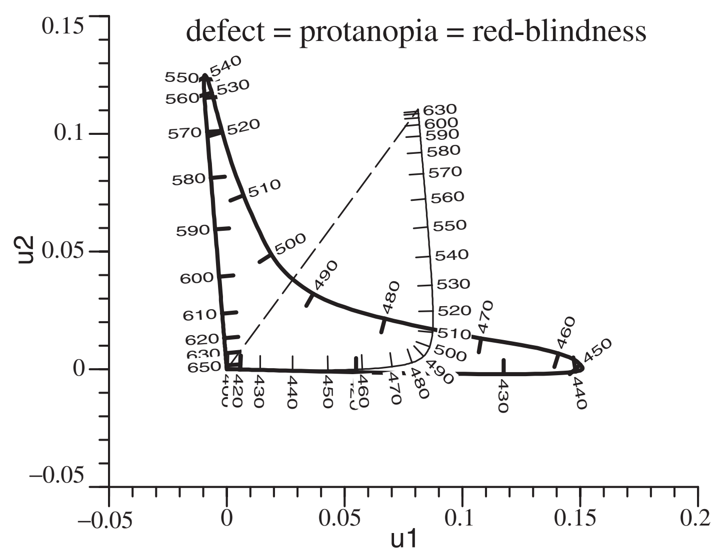

Fig. 12. Protanopic color defect considered as the absence of red receptors. The heavy solid line is the protanope's Locus of Unit Monochromats (LUM). The thinner solid line shows the vectorial composition of the equal energy light. The dashed line is a locus of neutrals—greys and whites as seen by this color defective observer.

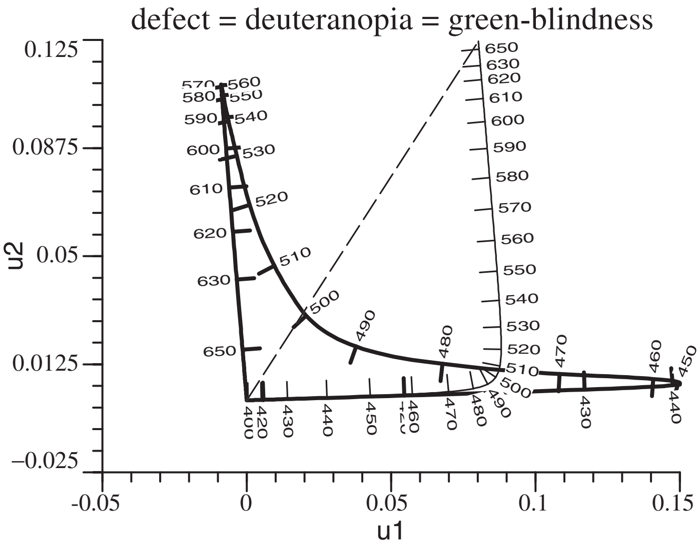

Fig. 13. Similar to Fig. 12, but now the subject is a deuteranope, considered to lack green receptors.

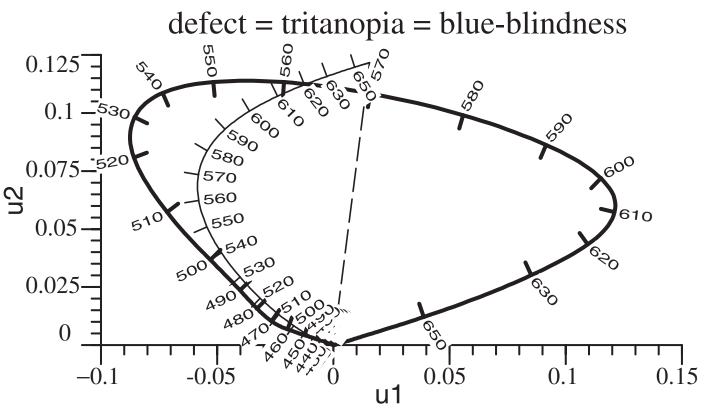

Fig. 14. Similar to Fig. 12, but now the subject is a tritanope, considered to lack blue receptors.

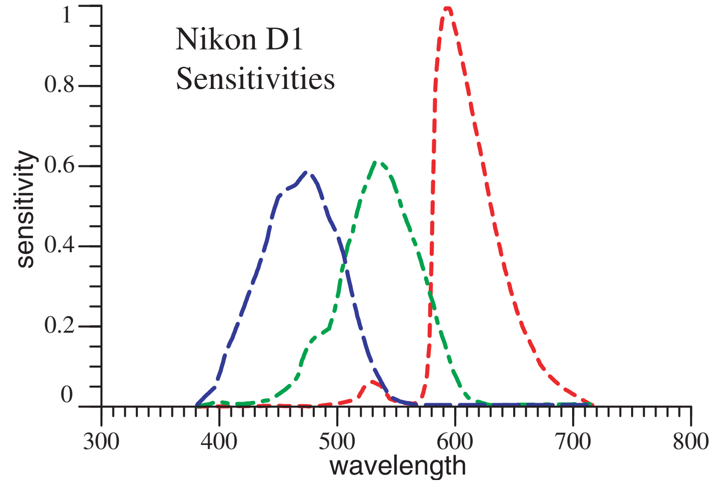

Fig. 15. The 3 spectral sensitivities of a Nikon D1 camera, as reported by DiCarlo, Montgomery, and Trovinger[29].

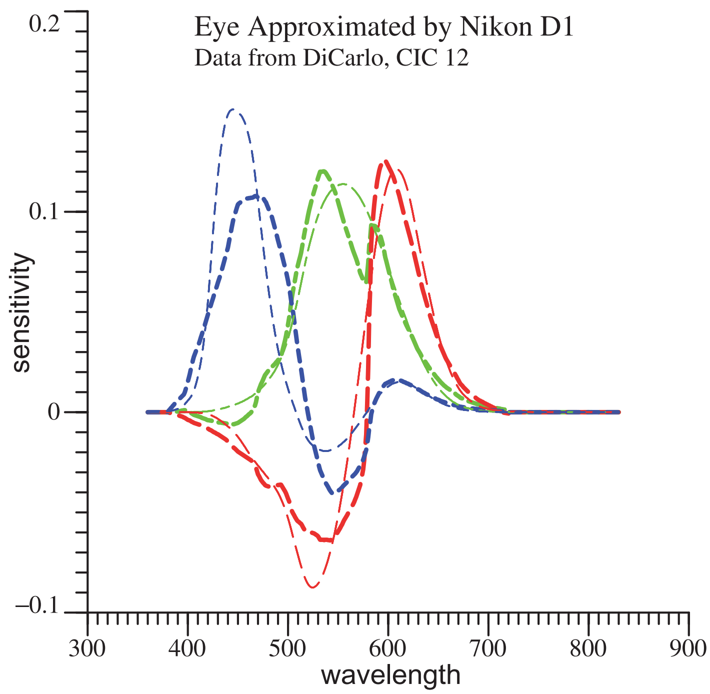

Fig. 16. Best fit to orthonormal basis Ω using the camera functions of Fig. 15. The thin curves are the human basis, while the thicker ones are the best fit. Dash-dot = achromatic, long dashes = red-green, short dashes = blue-yellow.

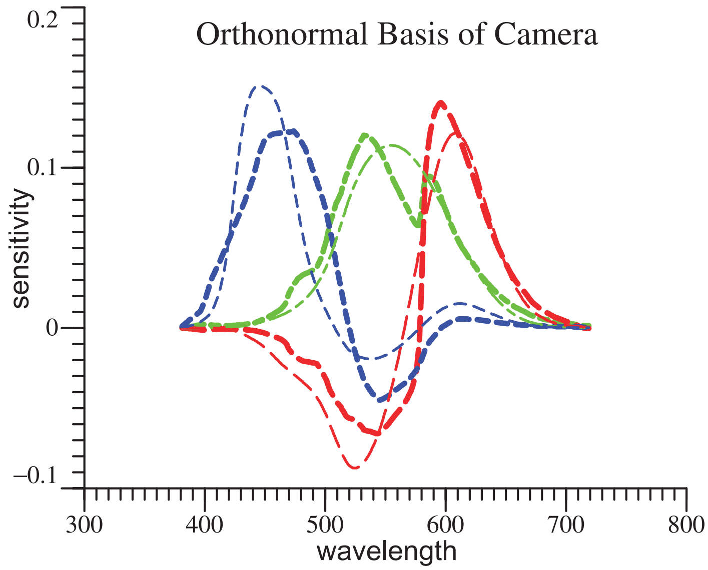

Fig. 17. Thinner curves are again Ω; the thicker ones are the camera's orthonormal basis.

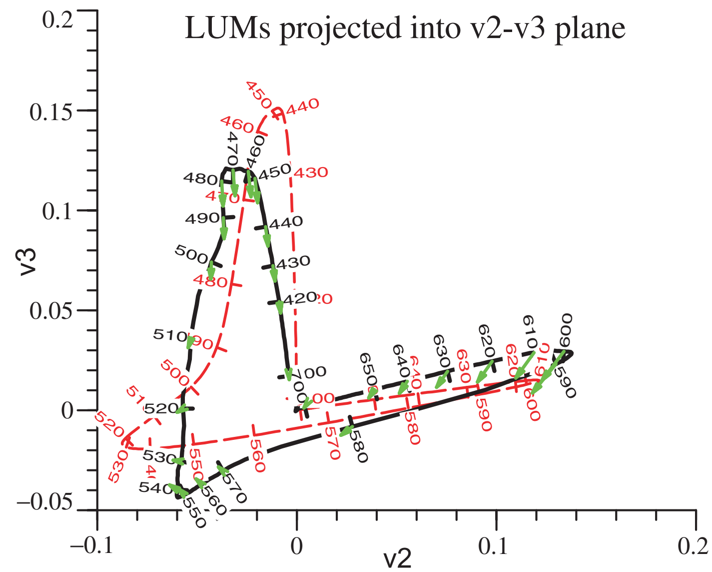

Fig. 19. Similar to Fig. 18, but the 3-dimensional curves are now projected into the v_2-v_3 plane.

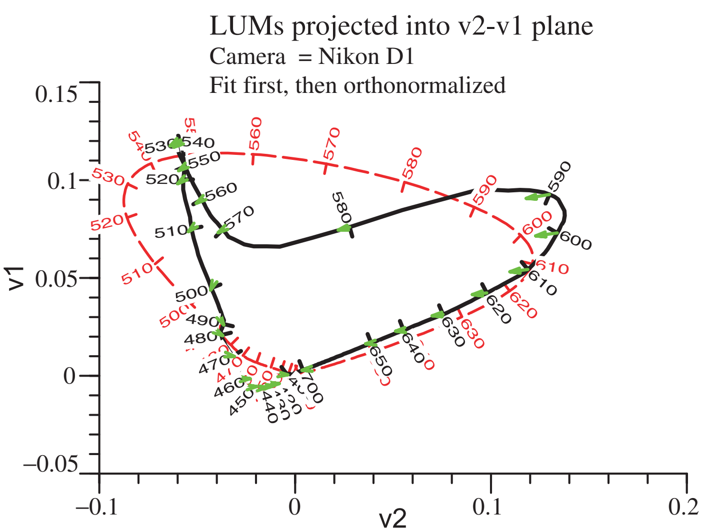

Fig. 18. Human and camera functions projected into v2-v1 plane. The dashed curve is the human LUM, meaning a parametric plot of . The solid curve is the camera's LUM. The heads of the short green arrows indicated the best fit of camera functions to the human LUM.