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LETTER TO THE EDITOR

Re: efficacy of coloured lenses for patients diagnosed with visual stress

To the editor,

Visual stress is a controversial area with opposite conclusions from systematic reviews.[1,2] Further randomised controlled trials are desirable. Unfortunately, the conclusions from the trial by Suttle and Conway[3] are invalid and regrettably misleading.

This is for two reasons: First, the CIE 1976 UCS chromaticities of the tints used by Suttle and Conway have been calculated using a published spreadsheet (https://visualstress.info/lens.htm) and are shown in Table 1, the first two columns of which are from their Table 1.

The difference in chromaticity between the 'Optimal' and 'Suboptimal' tint averaged just 0.024 (SD 0.012). In a study by Aldrich et al.[4] the difference in chromaticity between two immediately successive examinations of 16 symptomatic patients by different examiners with different colorimeters averaged 0.037 (SD 0.022). This figure may be inflated by differences in methods, but suggests that both the 'Optimal' and 'Sub-optimal' lenses were within the error of measurement. In the study by Wilkins et al.[5] the optimal and suboptimal tints differed in chromaticity by 0.065, nearly three times the difference used by Suttle and Conway.[3] The studies are not therefore comparable.

Second, it appears the 'optimal' lenses were selected by methods that restricted their precision. The recommended colorimetry procedure has an initial stage in which 12 different hues are presented at varying saturation, and the best compared. In an important second stage, hues 10 and 20 degrees from the provisional optimum are also compared to improve the precision. In Figure 1 the square represents the chromaticity of white light and the chromaticities of the 'optimal' lenses form a circle around this, the further from white the greater the saturation. Those chromaticities with the same hue angle are connected by lines and show that the range of hue angles was less than would be anticipated.

The method by which the 'Sub-optimal' tints were selected was to turn the hue wheel 'slowly'. A continuous change in hue alters the proportional excitation of the photoreceptors and can be stressful if not very gradual; it is generally avoided in practice. It is possible that the speed of change was responsible for the differences in the study by Suttle and Conway[3] and that by Wilkins et al.[5]

When reading rate was measured in five symptomatic patients under light of different chromaticities, the rate decreased with the departure in chromaticity from subjective optimum.[6] According to the function shown in Figure 3 in reference 6 in the paper by Suttle and Conway,[3] the reduction

Table 1. Chromaticities of the 'Optimal' and 'Sub-optimal' lenses used by Suttle and Conway.[3]

		'Optimal'			'Sub-optimal'				
'Optimal' tint colours	'Sub-optimal' tint colours	u′	v′	trans	u′	v′	trans	Chrom diff	Trans diff
B2+P6+P4	B5+B4+B3+P6 +P5+P4	0.186	0.418	38%	0.196	0.427	29%	0.014	−9%
R6+R5+R4 +R3+O4	P6+R5+R4+R3	0.297	0.479	29%	0.287	0.468	34%	0.015	5%
T5+T2+B5	T5+T4+T3+B5 +B3	0.159	0.471	38%	0.164	0.457	32%	0.015	−6%
T5+T4+B5+B4 +B2	T2+B5+B3	0.163	0.425	28%	0.152	0.457	33%	0.033	5%
R6+R4+R3 +O5	R6+R3+O3	0.285	0.473	36%	0.276	0.487	43%	0.017	8%
R4+O5+O4 +O2	O5+O4+O3+Y3	0.285	0.524	41%	0.237	0.533	59%	0.049	19%
B2+P4+P6	B5+B4+B3+P6 +P5+P4	0.186	0.418	38%	0.196	0.427	29%	0.014	−9%
T5+T4+B5+B4 +B2	B3+B2+P6+P5	0.163	0.425	28%	0.174	0.408	30%	0.021	3%
R5+R3+O5 +O4+O3	P6+P5+R6+R5 +R4+R3	0.290	0.498	33%	0.296	0.464	25%	0.035	−8%
P6+P5+P3+R3 +G2	P3+R6+R4+R3 +G2	0.282	0.427	13%	0.304	0.436	12%	0.023	−1%
R6+R4+R3 +O5	R4+R3+O4	0.285	0.473	36%	0.285	0.477	40%	0.004	4%
G4+G3+T5 +T3	G4+T3								
B4+P6+P3	P4+R3								
P3+R3	P5+P4+R5+R4 +R3	0.274	0.435	33%	0.297	0.453	25%	0.029	−9%
R4+O2	R3+O5+O4+O3	0.276	0.518	52%	0.282	0.498	39%	0.020	−14%
O2	O3+O5+R4	0.254	0.519	70%	0.248	0.493	57%	0.027	−13%
Y5+Y4	O4+O3	0.212	0.505	88%	0.230	0.499	74%	0.019	−13%
P6+R3	R3+O4								
P6+B2	B5+B4+B3+P3	0.181	0.432	50%	0.201	0.408	29%	0.031	−21%
B3+P3+B4 +P4+B5	B4+P5+P4								
G4+T4	G5+G4	0.194	0.484	69%	0.200	0.488	67%	0.007	−2%
O2+R5	R5+R3+O5+O4 +O3	0.262	0.519	58%	0.290	0.498	33%	0.035	−26%
R3+O5+O3	R4+R3+O4								
G2+B3	G3+B3	0.156	0.503	39%	0.174	0.487	51%	0.024	11%
G2+T5+T3	G2+T2	0.148	0.510	33%	0.128	0.508	28%	0.019	−5%
R5+R3+O5 +O4+O3	R6+R5+O2	0.290	0.498	33%	0.267	0.519	50%	0.031	18%
G5+G4+G2 +T5+T3	G4+G3+T5+T2	0.138	0.516	23%	0.134	0.503	25%	0.014	1%
T5+T4+B5+B4 +B2	T5+T3+T2	0.163	0.425	28%	0.146	0.474	32%	0.052	4%
R5+R3+O5 +O4+O3	R6+R5+O2								
							Average	0.024	
							S D	0.012	

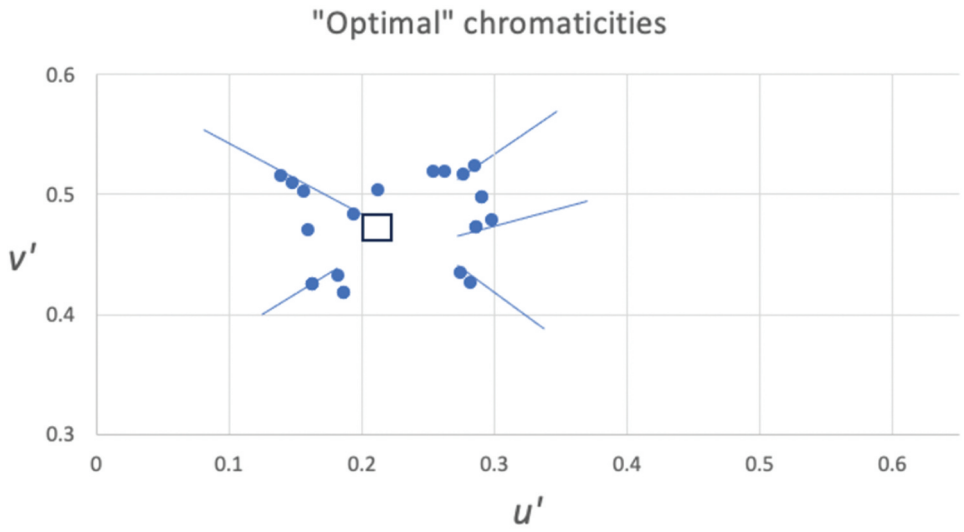

Figure 1. "Optimal" chromaticities. Those having the same hue angle are connected by lines.

in reading rate expected from a difference in chromaticity of 0.024 averaged about 12% and is therefore difficult to measure.

In conclusion, the 'Optimal' tints are unlikely to have been optimal and the 'Sub-optimal' tints sub-optimal. Even if they were, the differences in reading speed expected from the differences in chromaticity were small. In the three other randomised control trials of colorimetry,[7–9] a difference in UCS chromaticity of at least 0.06 has been used. The clear differences between optimal and sub-optimal lenses include oxygenation of the visual cortex[7] and provide a physiological rationale for the use of tints.

The results of Suttle and Conway are exactly as expected given the methods and parameters used. However, these methods and parameters mean their conclusions are flawed.

Disclosure statement

The author invented the Intuitive Colorimeter but emoluments have been donated to the University of Essex to support a student.

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