

PO Box No 42 Hexagon House
Blackley Manchester M9 3DA England

Telephone 061-740 1411
Telex 667841/2/3 Manchester
Telegrams Bridycor Manchester



Imperial
Chemical
Industries
Limited

Organics
Division

makers of dyestuffs,
pigments, industrial
and polyurethane
chemicals

Mr. R. G. Kuehni,
Mobay Chemical Corporation,
P.O. Box 385,
Union Metropolitan Park,
Union, N.J. 07083,
USA.

Your ref

Our ref

Date

AR.TS/T/KMcL/BS

12 February, 1976.

Dear Mr. Kuehni,

Your letter dated 3 February only arrived after I had sent you mine dated 6 February, and hence the second paragraph of that letter has now been answered. I will quote these figures in the published version of my Williamsburg paper with "private communication" as the reference. I welcome this further opportunity of doing what we would have done in Williamsburg had time permitted.

Before dealing with specific points there is a general question which I would like to answer: this concerns the testing of formulas against acceptability data when I believe such data to be biased. It may surprise you to learn that at Driebergen in 1971 I expressed a view which was identical with that subsequently expressed in your unpublished CIELAB paper dated 3 September, 1974, i.e. "any bias introduced is unconscious. Under such conditions one can expect that a similar unconscious bias would be introduced into perceptibility judgements". My view did not appear in "Color Metrics" however: I don't know why - probably I forgot to fill in a discussion slip. All the assessments I have ever made and all those I have organised others to make have been of perceptibility with or without "unconscious bias" and, of course, the idea of using Grey Scales which I pioneered in the 1950s, ensures that it is perceptibility which is being assessed. I was therefore pleased when in your first JCA paper you concluded that there was an "apparent absence of any fundamental difference between perceptibility and acceptability" but disappointed when in your second JCA paper you found differences between your acceptability ellipses and the MacAdam-Brown and Wyszecki-Fielder perceptibility ellipses only to be pleased again with your JSDC paper which stated unequivocally "There are no apparent systematic differences" which is obviously your current opinion.

However, in May 1975, I found that the optimum hue weighting for all the sets of acceptability data I had studied was less than the optimum lightness weighting whereas the converse was true for the MMB perceptibility data and probably also for the Robertson perceptibility data too though unfortunately he did not split chromaticness differences into their components of chroma and hue.



This cannot be a coincidence and therefore I had to conclude that textile shade passers were biased and that the CIE were right to ask for pure perceptibility data before accepting CIELAB as a CIE Recommendation.

The answer to your question as to why I did not propose a perceptibility weighting factor of 2 is very simple: my responsibility is only to the SDC Colour Measurement Committee and ISO/TC38/SC1 who are only interested in acceptability decisions for which the optimum CIELAB l, c, h weightings are 1:1:1.5. Had the CIE adopted the optimum perceptibility weightings 2:1:1 then neither of these two committees would have switched from ANLAB to CIELAB 2:1:1 because this equation would not be among the best established equations for quantifying acceptability. What we should have done is anybody's guess; my personal advice to both committees would have been to stick with ANLAB until the current spate of optimisation studies have been completed and then decide.

I am surprised that you make deductions about hue-chroma bias from the fact that the optimum lightness weighting for acceptability is 0.5-0.7 as shown by myself in 1970 and by Strocka in 1971 because it is surely better to determine optimum weightings for lightness, chroma and hue and the values I showed at Williamsburg - up-dated by data and normalised at l = 1 for ease of comparison - are as follows:-

	l	c	h	
D&F 286	1	1.0	2.0	.8
Hatra 589	1	0.9	1.3	.69
JPC 169	1	1.1	5.3	
KM 289	1	0.75	1.65	.45
MMB	1	0.5	0.7	.70

The JPC 169 data comes from J. & P. Coats and is unique in that the standards were of 169 different colours - chosen at random from bulk production: only one sample was assessed against each standard and these were again chosen at random. The criterion was acceptability.

The next point is "saturation crispening" though we must find a different name because

(a) "crispening" was a term coined by Takasaki to describe the increase in perceptibility which occurs when the background resembles the sample/standard pair and

(b) we are concerned with chroma and not saturation - see Judd & Wyszecki, Ed. Vol. 3 page 256.

I use the term "McDonald weighting" because although I first discovered it (Driebergen) I abandoned it when I found it failed for the Hatra 419 data and it was McDonald who explored it fully. You say that I must make up my mind about this factor: what would you conclude from the following facts:-

<u>Data</u>	<u>Optimum McDonald Weighting</u>
JPC 169	0.060
D&F 286	0.035
JPC 309	0.0275
MMB 518	0.015
KM 289	0.010
Hatra 589	0.0045

I do not "keep lumping" the D&F and Hatra data together. This was originally done by Jaekel and is completely justified when the objective is simply "Which established equation is not reliable?" When the objective is the development of a more reliable equation or a better method then I have always kept the acceptability data sets separate.

I think the difference between your general approach and mine is essentially this. We both know that CIELAB is nowhere near reliable enough to permit "single number" shade passing and sorting. You believe that "we will shortly have a better formula" and I assume by "shortly" you mean within 2 years. Such a formula can undoubtedly be devised now but I don't think that a formula which merely reduces the range of ΔE values representing the same degree of acceptability is worth developing especially if it fails to permit easy splitting into lightness, chroma and hue components. The solution to the "single number" method will take many years but will undoubtedly be facilitated if everybody in the meantime uses the same equation as this would permit pooling of data. I don't think you would deny that there is no established equation more reliable for quantifying acceptability and perceptibility than CIELAB. I would find it much easier to interpret your ellipse data if they were plotted in the CIELAB AB diagram as in this diagram we don't get the 30:1 ratio for equal perceptibility we get in the x y diagram and constant hue lines are straight.

Yours sincerely,



K. McLaren