STUDY AND ANALYSIS OF CHROMATIC THRESHOLDS IN THE CERAMIC INDUSTRY I

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ABSTRACT

The results obtained in our laboratory, by measuring chromatic thresholds with different clarities and tones, will serve to determine the influence of purity on the discrimination capacity in the ceramic sorting process.

Key words: *Chromatic threshold*

1. INTRODUCTION

Nowadays, colour sorting (chromatic classification) is performed throughout the entire ceramic floor and wall tile industry by means of visual human inspection. This classification method allows discriminating between differences in the final appearance of the pieces, either because the differences are directly due to colour or because they are due to other factors (gloss, texture, etc.).

Though the discrimination capacity of a group of sorters may be more or less similar as far as sensitivity is concerned, the criteria by which the different shades are to be grouped or the number of shades in which a lot is to be divided are difficult to harmonize, since this contains a subjective component. For this reason, it is considered important to standardize this process, determining the chromatic thresholds and their variations with regard to lightness, saturation or tone.

2. EXPERIMENTAL TECHNIQUE

For the study of chromatic thresholds in our laboratory, tests were used, of a circular shape, with an outer diameter of 20 cm, which were obtained by means of a temporal fusion of two cards of known chromatic coordinates rotating on a motor at 3,000 rpm.

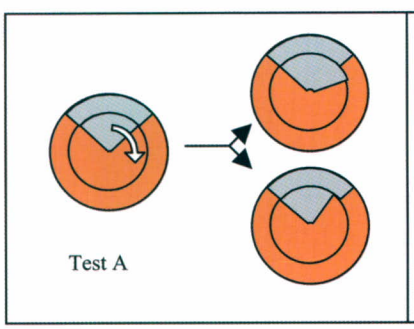
The lighting selected for the experiments was 400 lux and 800 lux, which are most usual in housing interiors, facades and terraces[1]. As predominant wavelengths, for the complete development of the experiment, the ends and middle of the spectrum, red, green and blue, were used; however, for this first experimental stage only red was used.

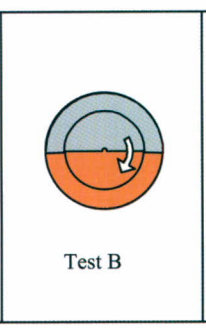
Standard observation conditions were used. The observers were placed at a distance of 2 metres from the sample. The distance is determined by the size of the sample.

Young observers were selected, involving students chosen from volunteers who had also been subjected to the Isihara test (to ensure they had normal vision) and the Farnswor-Munsell[2] test (to determine the level of visual perception before starting the experiment). The angle of view was kept constant, always positioning the observer in the same way. It was also taken into account that the adaptation field had to subtend an area of at least 10°, so that the chromatic discrimination would not depend on background luminance.

The study was conducted at constant Luminance. Each centre of colour was progressively desaturated adding grey card of equal luminance (β= 0.52), obtaining a chromatic straight line that went from red (x = 0.58, y = 0.35) to grey (x = 0.42, y = 0.41). The coordinates of the chromatic samples studied were located on this straight line and were chosen in such a way that they were distributed along the line without producing any visual interferences between them. Three samples were involved, which matched the following mixes and chromatic coordinates:

A = 25 % grey – 75 % red	x = 0.54	y = 0.36
B = 50 % grey – 50 % red	x = 0.51	y = 0.38
C = 75 % grey – 25 % red	x = 0.46	y = 0.40





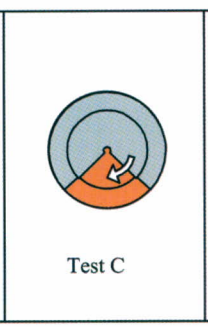


Figure 1. The circular crowns act as reference bases and the proportions of red and grey remain constant at all time, whereas the inner circumferences vary the percentage of grey in a few positive or negative degrees in respect of the proportion in the reference base.

3. RESULTS

For each of the points of the previous section, with the two illuminations indicated above, the chromatic thresholds were determined in the two directions of the straight line, defining a range within which, though they were in fact different tones, the observers perceived these as equal. In addition, the point was also established which the observers considered the changing point, i.e., the point at which the observers perceived the tone to be evaluated as going from more saturated to less saturated (always in relation to the reference tone).

The results were as follows:

TEST	For 400 lux THRESHOLD RANGE		For 800 lux THRESHOLD RANGE	
	Test turn (degrees)	xy coordinates	Test turn (degrees)	xy coordinates
A	6°	$2.8\ 10^{-3}$	9°	$4.3 . 10^{-3}$
B	6°	$2.8\ 10^{-3}$	6°	$2.8 . 10^{-3}$
C	6°	$2.8\ 10^{-3}$	3°	$1.4 . 10^{-3}$

4. CONCLUSIONS

At 800 lux, the results were of the same order as those obtained by Wright[3] and Mac Adam[4]. As the point moves along the straight line of red to grey, and as purity decreases, the ranges of chromatic discrimination become narrower.

When luminance is lowered (400 lux), the chromatic threshold does not depend on purity.

5. ACKNOWLEDGEMENTS

Study funded by the EU as a part of the European project MONOTONE (G1RD-CT-2002-00783).

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