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COLORADD. COLOR IDENTIFICATION SYSTEM FOR COLORBLIND PEOPLE

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ABSTRACT In most countries, colorblindness affects 10% of the male population. It is estimated that 350 million people in the world are colorblind! This handicap incurs limitations as well as uncomfortable personal and social situations for those afflicted that depend on others to choose products in which color is a predominant factor, such as pieces of apparel, decoration, traffic, recycling, identifying specific rooms in museums and other public spaces when color is the relevant element for choosing. A sample group of colorblind people questioned in a study found relevant the development of a system which would allow them to identify colors. The development of a graphic color identification system was the answer to this need, its concept and structure making it universal, easy to communicate and memorize - a unique, universal, inclusive and non-discriminative language that enables the colorblind to identify colors, with a wide infinite spectrum of usage whenever color is a factor of identification, orientation or choice. This system can be applied to a variety of products and allow the colorblind to reduce or even eliminate their dependence on others.

ColorADD was born for all, allowing full integration whilst keeping the privacy of colorblind - including without discriminating. ColorADD creates added economic and social value to companies or entities that use the code, by offering to their consumers an innovative product with a strong social footprint. Also, Culture is a strategic activity of our mission and consequently it is one of our primary concerns. At several national museums, ColorADD is already adopted not only as part of the museums themselves but also several activities are already developed to allow people/children to become acquainted with this code, thus providing another acquisitive tool of universal and transversal utility. Our target is to take color to all!

KEYWORDS Colorblind; Inclusion; Culture; Museums; Accessibilities

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1. Introduction to the colorblindness problem

Colorblindness is the common denomination to a congenital alteration related to the incapability to distinguish several colors of the spectrum due to a visual deficiency (FIG. 1).

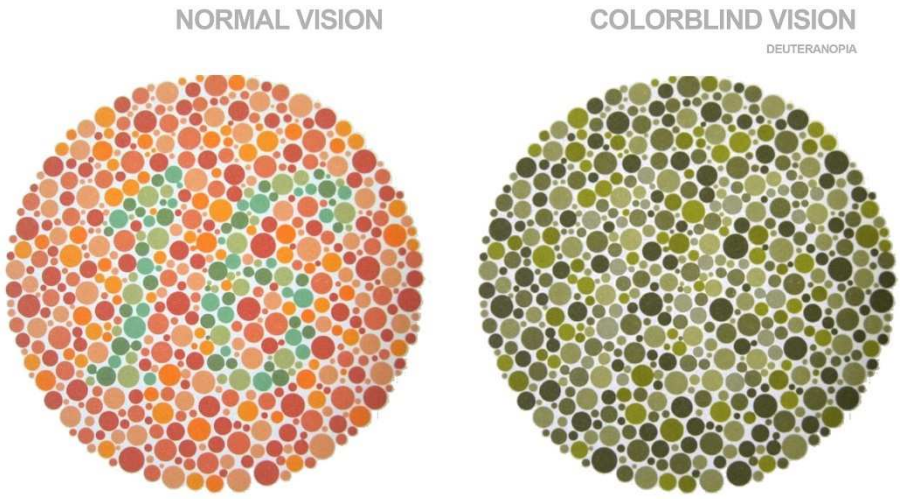

FIG. 1 - Normal and colorblind vision.

This people have a normal vision relatively to the other characteristics which compose it, even though the deficiency hampers, or even makes it impossible for those afflicted to perform certain everyday social and professional tasks. Colorblindness affects approximately 350 million people - 10% of the world's population and it's a handicap usually of genetic origin associated to a flaw in the X chromosome. Because of this, 98% of colorblind people are male.

The first symptoms of colorblindness are detected at school age due to the difficulty in interpreting drawings, maps and identifying colored pencils. Later in life, a colorblind person is prohibited of performing certain jobs, while some professions will bring added difficulties. Similarly, managing daily routine poses problems, as well as, for instance, buying and choosing wardrobe as well as using maps and signs to provide orientation. Even while accessing internet some texts can become illegible due to the use of certain colors. Some companies have started creating web pages which can be seen correctly and easily

by all. This has been possible due to the rising awareness that colorblind people represent a high percentage of the world population.

2. Objectives

Once the problem had been identified, its extent and impact on the subjects was evaluated. On a first phase of the study, a sample of color blind people was identified and presented with a questionnaire. Its purpose was to identify the main difficulties of the respondents concerning their color blindness and the processes and methods used by them to lessen and overcome these obstacles.

The collected information was treated and analyzed. Based on these results a conceptual basis was defined, capable of constituting a universal method of graphic color identification, easy to comprehend and memorize.

3. Materials and methods

Using primary colors, represented through simple symbols, the system was constructed through a process of logical association and direct comprehension, allowing its rapid inclusion in the "visual vocabulary" of the user. This concept makes additive color a mental game, which lets the colorblind relate the symbols amongst each other and with the colors they represent, without having to memorize them individually.

The system proposed is based on the search of the pigment color, using as basis the primary colors – blue (cyan), red (magenta) and yellow its additive secondary colors (FIG. 2) and not the light color (RGB), because the colorblind person does not possess the correct

vision of the colors, nor a tangible knowledge of how their addition works.

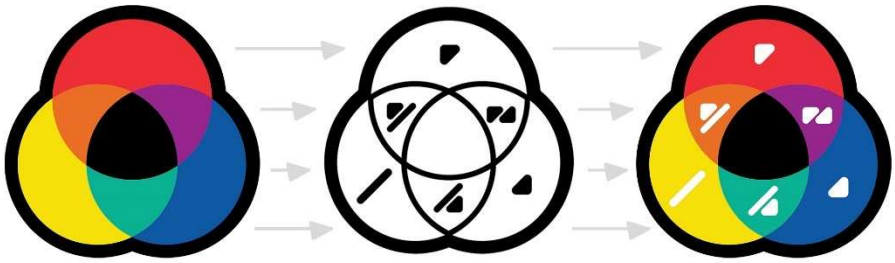

FIG. 2 - Primary color addition – pigment colors.

Each primary color of the code is associated to three forms which represent red, yellow and blue; from these three is the code developed. Two additional forms were added representing black and white; in conjunction with the other elements they represent lighter or darker tons of the colors (FIG. 3).

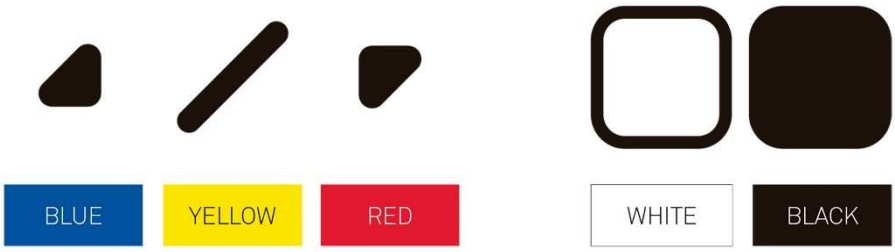

FIG. 3 - Graphic symbols for 3 primary pigment-colors and white and black.

The secondary colors can be formed using the basic forms as if "mixing" the primary pigments themselves (FIG. 4), making their perception and subsequently the composition of a color pallet easy.

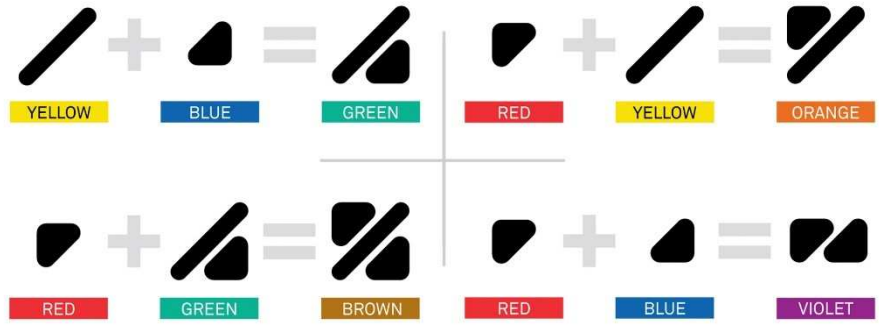

FIG. 4 - Graphic symbols – three primary colors and their addition.

By associating the icons representing white and black to define darker and lighter tones to the three basic forms and their additions, a wide palette is constructed as observed in FIG. 5.

FIG. 5 - Graphic representation of color addition with dark and light.

Conventional color designations were attributed to the additions and other combinations of colors, especially those used in apparel.

Grey, was divided into two tones: light grey and dark grey (FIG. 6). The importance of gold and silver in clothes implies the creation of a specific icon. Considering the logic of the codes' construction, these colors are represented by the combination of the golden-yellow and the element representing shine to define gold; light grey with the same element identifies silver (FIG. 7).

FIG. 6 - Graphic symbols – tons of grey.

FIG. 7 - Graphic symbols – gold and silver.

The totality of the code, represented in FIG. 8, covers a considerable number of colors and can be easily conveyed through information posted at the sales point, on web sites, or the product itself.

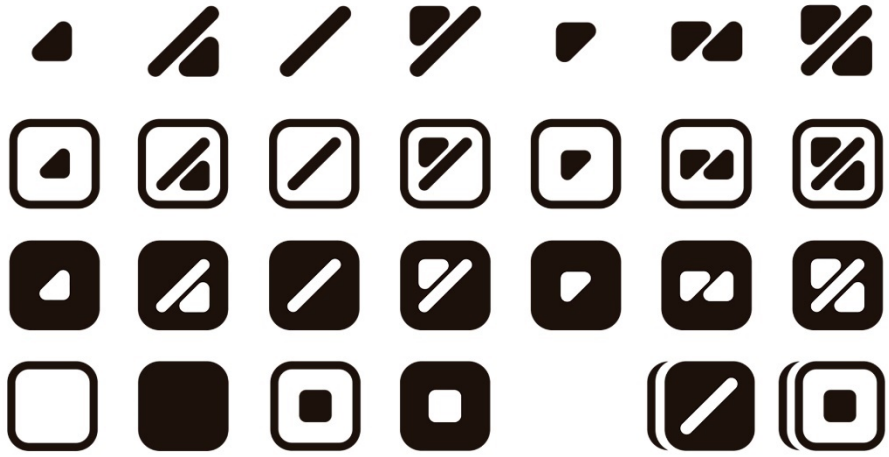

FIG. 8 - Monochromatic graphic code.

4. Results

The application of the system is transversal to all the areas of the global society, regardless of their geographical localisation, culture, language, religion, as well as to all the socio-economical aspects.

School and stationery. It is at school-age that usually appear the first and sometimes traumatic situations and difficulties caused by the wrong color identification. The inclusion of the system in the school and stationery leads to inclusion (FIG. 9), allowing the colorblind kid a perfect integration, with no doubts and shames.

FIG. 9 - School material.

Museums and cultural infrastructures. ColorADD code is already in use in several museums – not only as part of the *spolium* but also as a support of communication and organization of the museum space (Fig. 10).

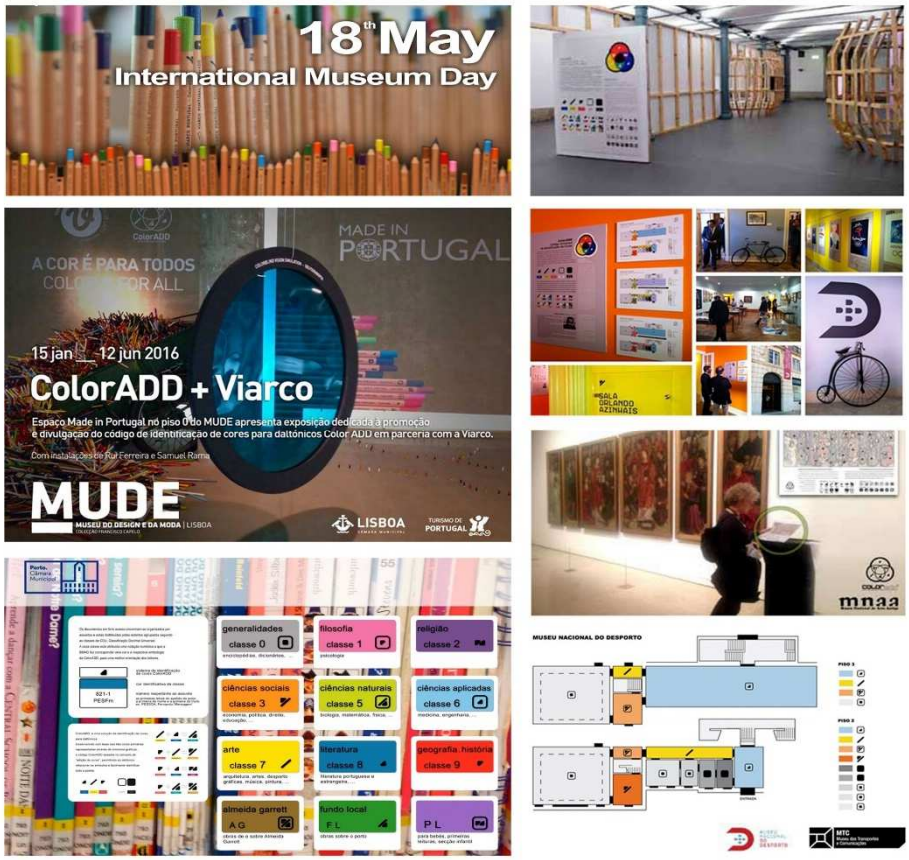

FIG. 10 - Design Museum Budapeste; MUDE, Design and Fashion Museum, Lisbon; National Sport Museum, Lisbon; Museum of Antique Art, Lisbon; Museum of Transports and communication, Porto and Municipal Library, Porto.

Health and services. The selection of patients at hospitals is made through color. At the ER, it is carried out an evaluation of the grade of "gravity" of a patient and a bracelet corresponding to a certain grade of priority is provided. The inclusion of the system in hospital services and spaces where color is an element of identification and guidance makes orientation and easier task to colorblind.

In many places, color is the element of identification of the different services. A colorblind, resulting from its handicap, cannot identify the color and its meaning. Also, many medicines have color as an identifying factor (FIG. 11).

FIG. 11 - Health and hospitals.

Transports. The Metro system maps are a different context but equally valid on what concerns the use of the color identification code, in this case to individualize the different transit lines (FIG. 12).

FIG. 12 - Metro map, Porto, Portugal.

Clothing and textiles. The developed code can be applied in multiple contexts in which color is important. One of the most relevant fields of application is in apparel and the color symbols can be applied to tags or integrated into the clothes themselves, similarly to maintenance and care information. The simple and stylized graphics and its monochromatic nature reduce the production cost of the labels in

paper or cardboard, textile or stamp (FIG. 13) and another implementation in cross-sector (FIG. 14).

FIG. 13 - Application to clothing tags.

FIG. 14 - Cross-sector implementation.

5. Conclusions

Each day, society grows more individually centred. The "wrong" interpretation of colors can harbor insecurity in social integration of the individual, whenever the projected personal "image" is a key factor in rendering judgment.

The color identification system, aimed at colorblindness, can be greatly beneficial to a group which represents such a significant percentage of the population. Its use, given the characteristics of the

system, means a practically insignificant cost and its adoption by the industry and society may improve the satisfaction and wellbeing of a group of individuals whose vision characteristics deprive them of a fully independent and tranquil everyday experience.

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