Colour Vision and Communication Design: Older People – Problems of Legibility and the Readability of Analogical Supports

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ABSTRACT

This paper presents the results of a research project which implemented a systematic approach to an overlap between Colour Vision, Visual Communication Design, Printed Colour, Legibility, Readability and Inclusive Design, for older people, with the aim to develop of a set of research-based communication design guidelines and recommendations for the use of Colour in printed material (analogical displays). The initial literature review included a critical synthesis crossing different areas and the second part of the project focused in the implementation of an experiment to measure the different colour experiences of the participants in four sample groups (two in UK and two in Portugal), using printed material, to find out the colours one should use in analogical communication material, being aware of the colour contrast importance (foreground versus background) and the difficulties experienced by older people to read and understand lettering, signs. After crossing the results from the two phases, and as main contribution of this research project, we developed a set of guidelines based on the reviewed literature and the sample groups' findings, trying to demonstrate the importance of these guidelines when conceiving communicational design projects, achieving visual comfort and understandability, especially for older people, in an inclusive design perspective, underlining the importance of having colour and colour vision knowledge to develop such projects.

1. INTRODUCTION

The EU and most other developed countries have identified population ageing as one of the key economic and social challenges to be faced. Most of us are aware that in an ideal world, inclusive products and services, would be standard and not the exception. To work in the Visual Communication Design area one needs to have knowledge of different techniques and how to manipulate them. Despite the knowledge in this professional circle, there is a gap in knowledge of Colour and Inclusive Design, and how to use them to develop communicational products. This paper summarizes the content and output of a research study concerned with colour, inclusive design and visual communication in analogical support for older people. Most of the studies that have been implemented until now addressing the research topic focus on the use of colour and text in digital displays, not in analogical supports. The research object of this study was the overlap between Inclusive Design, Visual Communication Design, and Printed Colour. The main objective was to introduce colour as a variable of great importance in Visual Communication, in an Inclusive Design perspective, having older people as target. Until now, little research has been carried out on how colours in form and background relationship affect older people. If text does not have sufficient contrast compared to its background, people will have problems.
2. METHOD

The study started with an exploratory qualitative literature review of the relevant material. From the theoretical contextualization, we were able to draw a hypothesis: “to produce a more inclusive design project when designing visual communication analogical products, designers must be aware of the issues related with colour and text legibility, due to the reading problems experienced by many users, like older people”.

The Project overlapped different areas of knowledge, among which: Colour contrasts and color measurement; Light sources (natural and artificial); The evaluation of the properties of the light sources and the influence of the surfaces; Ergonomics; Inclusive design; Visual Communication; The evaluation of the colour aspects inside visual communication area; Legibility and the obstacles to reading; Older people and visual limitations. The work involved experts in the area of Colour, Inclusive Design, Visual Communication and Older People, as well as the users and the associations of people with impairments. For the second stage of this research project, we decided to develop a direct field work with the users, i.e., an experiment (active research) using sample groups of older people with the same gender composition and general characteristics. In order to allow a detailed exploration and the handling of complex and diverse information, a qualitative method was chosen. The process involved development of tools to work with the groups, especially printed color material always relating front and background colours. The search was carried out in several rounds, using the same material in similar lighting conditions and the same distances. We had the light up, on average, 900 lux (illuminance), as recommended by O’Neill (2003). The examples were very simple and designed to be readily understood. They were written in plain English for the UK sample groups and in Portuguese for the Portuguese groups. For this reason no technical terms were required. The words and sentences acted as forms, using different colour schemes, in form/background relationship.

Every sample group was formed by 8 people, with ages comprised between 65 and 85, all in sight normal conditions for people in this range of age, only with aged vision, but with no specific sight diseases. Several messages, in different color contrasts were printed on A4 format cards for a total of 24. All messages were created using 48 point Myriad. The lettering size was chosen having in mind that the group members would be placed at a two meters distance from the cards. For the colour production, we used the Pantone Matching System Colours. Information for each group included the gender, age, requirement for eye wear. The results for colour blindness were recorded as “normal” for all group members. To be selected for each of the sample groups, the members couldn’t have any eye disease, only older vision. After informed consent had been obtained, and the subjects’ visual acuity and ability to perceive colour had been tested, each one was seated in front of a researcher holding the A4 cards, with a 2 meters distance between them, and asked to read the text written in each card, where object (text) and background had different colour combinations. There were also cards with different types of lettering and spacing, but using always the same letter dimensions. We also wanted to test the level of legibility and the eventual experienced difficulty, as well as the level of eye comfort and color contrast. We also used eye-tracking, in a way to help us to understand the eyes movements and the efforts made by each participant to read the cards.

3. RESULTS AND DISCUSSION

One of the effects that growing older has on vision is that, on average, less light falls on the retina, and there is less tolerance to glare. Loss in the fovea affects visual acuity and
color perception and general loss of vision across the whole visual field. Studies (Evans et al., 2002) suggest that more than 12% of people over 75 have some sight loss. Visual acuity is reduced by 10% for 60-69 year olds, 30% for 70-79 year olds and 35% in the over-80s. In the UK, 65,000 people are diagnosed with low vision each year (Morris, 1999). Vision is one of the primary senses and serious or complete loss of sight also has a major impact on a person’s ability to communicate effectively and function independently (Jones, 2007).

With age, changes to the eye increase sensitivity to glare, difficulty of adapting to changing light levels, and make contrast and color harder to discern. A good color use for visual communication, as well as helping to improve visual performance, it may also increase general well-being and health. The effect of sight ageing is partially attributed to the yellowing of the retina, lens and vitreous humor yellow with age reducing the contrast sensitivity of the eye (Kelly, 1993). The effect of age on measurement legibility is further compounded by a reduced ability of the iris to dilate, under all light conditions.

The influence of contrast in reading and legibility is important not only because text of a wide range of contrasts is encountered in the environment but also because many ocular conditions lower the effective contrast of the reading stimulus. In general, reading is found to be fastest when the luminance difference between text and background is maximal. Lippert (1986) reported that legibility of briefly presented digits depended on the colour difference between the digits and the background. Tinker and Paterson (1928) found the legibility of coloured inks on differently coloured papers to depend primarily on the luminance difference between the text and the background, but the range of conditions that they could examine was limited by the nature of their stimulus medium.

When creating a composition, either something freeform, or a more text based layout, a determination for the final impact of the whole presentation needs to be identified.

Every visual presentation involves figure-ground relationships. This relationship between a subject and its surrounding field will evidence a level of contrast; the more an object contrasts with its surrounds, the more visible it becomes. When we create visuals that are intended to be read, offering the viewer enough contrast between the background and the text is important. The human eye requires contrasts for visibility and legibility. Colours of contrasting values stand out from each other. With colour deficits, the ability to discriminate colours on the basis of lightness is reduced. Designers can help to compensate for these deficits by making colours differ more dramatically in all three attributes.

After the implementation of the experiment with the sample groups of older people, we could achieve findings, which were confronted with the drawn hypothesis. We were able to verify that not only we had proved the hypothesis but also we had amplified the initial knowledge with a contribution for the study area.

4. CONCLUSIONS

With the sample groups, some conclusions were found for an inclusive approach in visual communication design, using colour in analogical material, for older people. The different rounds of tests allowed us to identify older people’s main problems with colour use for visual communication. Overlapping the literature review and the experiment we were able to draw some recommendations; good legibility helps all users, but for people with low vision the issue is crucial for reading text; the text and background color combination should have high contrast; a clear open typeface (font) should be used for text; the characters must be of good proportions with clear character shapes; text should not be placed over a background image
or over a patterned background; white or yellow type on black or a dark color is more legible; small type and very bold type tend to blur for some people, reducing legibility; avoid shades of blue, green and violet for conveying information since they are problematic for older users; use no more than five colours when coding information; be sure the elements have a contrasting colour value unless you want the elements to just blur together; excessive use of colours can be distracting; when using colours, one must have in mind that older people have a harder time distinguishing between colours in the cooler range - blues and greens particularly; some individuals are colourblind and find it difficult to distinguish between red and green; color is not appropriate as the sole differentiating feature between different elements - they should vary in other design features as well; varying the value of colors (the lightness or darkness) by at least two levels will enable most people to differentiate between the colours.

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