Hunjet, Anica [1]

Ivančić, Jelena [2]

THE IMPACT OF COLOUR PSYCHOLOGY ON THE CRIDENS DESIGN

Abstract:

The energy of each tone of colour has an emotional and psychological effect on an individual which is used as a tool in informal communication. Therefore, when designing new and renovating existing logotypes, designers do not randomly choose colours, but try to convey a certain message with the aim of being recognised. The fact is that colours on a symbol (logo) affect the visual perception and recognisability of individual products, but also of institutions.

The paper discusses briefly the history of colour psychology, which is followed by an explanation of the way human eye perceives colour and daltonism.

Likewise, we briefly review the application of colour psychology in marketing. After that, the logo of the Cridens Company, part of the Mehun Dental Laboratory, will be presented and explained. Cridens is a company that is engaged in the creation of websites and promotional leaflets, but also comprises a counselling centre for patients of the dental laboratory. The Cridens logo has only two tones of colour, blue and grey, in almost equal proportions. It will be explained in more detail why the company has changed its name and how the newb logo has been designed.

Author´s data:
[1] Anica, Hunjet, izv. prof. dr. sc., Sveučilište Sjever, 104. Brigade 3, Varaždin, anica.hunjet@unin.hr
[2] Jelena Ivančić, jivancic@unin.hr

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Introduction

The scope of work of the company Cridens encompasses professional training and seminars, web and graphic design, patient counselling and business consulting. The former name of the company was Dental Consulting, however, as it was rather long, the decision was taken to rename it to something shorter and more accessible. This company is associated with the Mehun Dental Laboratory in Varaždin. Every logo is connected with colour psychology, i.e. colour is an integral part of each logo or brand and makes it recognizable. It is important to choose colours which are compatible with the business activity as they can attract or alienate final customers. Colours can move final users to feel or do what we want, thus it is important to be familiar with colour psychology when designing a logo of a company. The first part of the paper will present the history of colour psychology, the impact of certain colours on people's moods, and how colours can be experienced differently by different people. After the definition of logo, a particular logo example will be discussed.

Colour psychology

Every civilisation has had its own myths and associations connected to colour. In 1960s anthropologists Berlin and Kay carried out a world-wide research of colour names. Many languages have only two names for colours, which usually denote dark and light, i.e. black and white. [1,2,3] Aristotle, who lived in the 4th century B.C., considered blue and yellow as primary colours, and connected them with basic polarities in human experience, such as Sun-Moon, woman-man, in-

out, yin-yang. Furthermore, he connected colours with the four elements: fire, water, earth, air. Aristotle observed the change of light during the day and so developed a linear colour system that ranged from the white light of noon to black, i.e. the darkness of the night. Artists in general accepted Aristotle's principles and continued using them for two thousand years, until they were replaced by the general colour theory which resulted from Newton's discoveries in the 17th and 18th centuries. Hippocrates, the father of medicine and Aristotle's contemporary, was known for recognising the therapeutic impact of colour and using it in medicine. He noticed that white and violet had a different therapeutic impact on patients than violet alone.

In the 15th century, during the Renaissance, a Swiss doctor Theophrastus Phillippus Aureolus Bombastus von Hohenheim, better known as Paracelsus, put a special emphasis on colours in the healing process. He travelled everywhere and tried out treatments that were controversial at that time.

In historic terms, the biggest contribution to the contemporary understanding of colour came from those individuals whose work was a combination of science and mathematics with art, of metaphysics and theology. The teachings of Martin Luther marked the beginning of a huge intellectual shift: the Church was no longer the only provider of education, and many disciplines became independent. This is also the time when art and sciences were ultimately separated. After that, the study of colour was left to scientists, whereas artists were considered to be naturally gifted for colours. [3,4]

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Isaac Newton published his first work on colours in 1672 - at the time, it was highly contested, but 40 years after publishing, it became the basis of optics. Newton passed white light through a triangular prism and noticed that light wavelengths were breaking under different angles, which enabled him to see separate components of colours in the spectrum. Furthermore, Newton created the first colour wheel. [4,5]
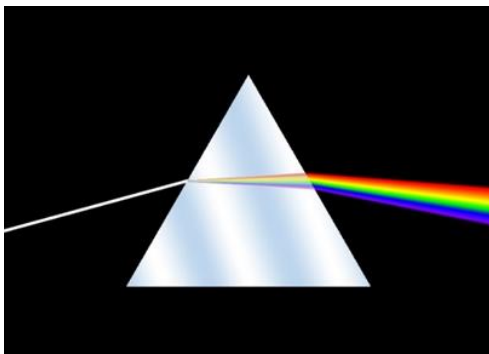

Figure 1: Newton's prism [6]

Johannes Wolfgang von Goethe disagreed with Newton's interpretation of colour. In 1810 he wrote a book "Theory of colours" which was printed in 1840. Although Newton's experiment with prism proved that light is divided into component colours, Goethe argued that if this was right, white light should be divided in all circumstances. When he directed white light onto a screen, he noticed that the centre continued to be white, whereas other colours appeared on the edges. This led him to Aristotle's idea that blue is the first colour visible in the dark, whereas during daytime the first visible colour is yellow. While Newton's theory was substantiated by science, Goethe was more interested in the psychological impact of colour. For Goethe it was important to follow the human reaction to colour stimuli, and this can be viewed as the origin of contemporary colour psychology. [4,5,6]

Understanding of colour flourished in the second half of the 19th century. In 1872 Scottish physicist James Clerk Maxwell developed a triangle-shaped graph as a result of his research into electromagnetic theory of light. He took red, blue and green as the primary colours and claimed that all the other colours in his triangle can be obtained by mixing these three colours in different combinations. This triangle is the basis of the chromaticity diagram devised by the Commission Internationale de I-Eclairage (CIE), which is still used for measurement of light and mapping of human colour perception.
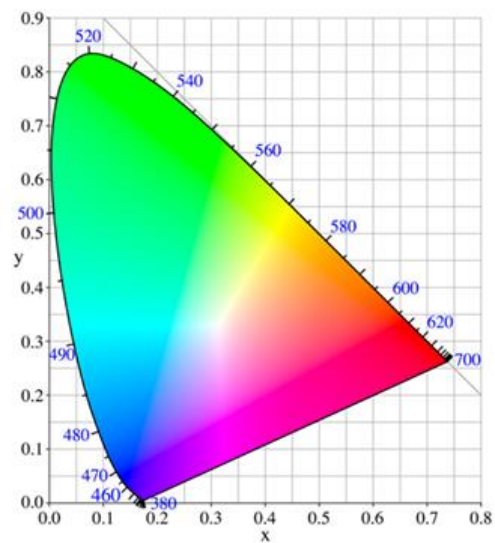

Figure 2: CIE system [3]

In 1878 physiologist Ewald Hering published his work "Outlines of a Theory of the Light Sense" in Vienna. He also studied the three-dimensional field of perception of the eye, but paid special attention to the introspective aspect of colour. He presented the issues of yellow light in the three-colour system. According to Helmholtz, yellow is necessarily a product of mixing green and red, but

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Hering realised this does not correspond to human experience. Hering claimed that mixing of red and green light would never happen, but rather they would eliminate each other. He concluded that there are not only three, but four elementary colour stimuli that code our perception through the so-called opponent processes. [7,8,9]
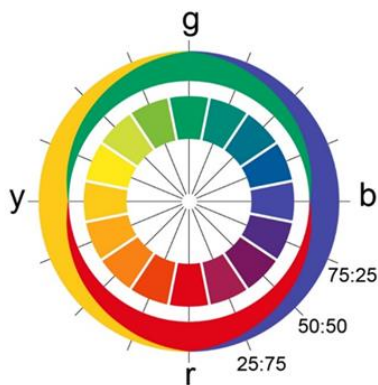

Figure 3: Hering's colour wheel [10]

In the late 20th century Anders Hard, Gunnar Tonquist and Lars Sivik designed a natural colour system (NCS) which is largely based on Hering's theory of colour perception by humans.

There was a growing interest in colour throughout the 20th century, and therapeutic use of colour has become a normal practice for contemporary doctors.

Albert H. Munsell, an art teacher, followed up on Roung's research to develop his own 3D colour sphere based on pigment rather than light. He noticed that pure tones vary in their lightness degree, and some colours are brighter than others. Therefore it was decided that all pure tones shouldn't be on the same horizontal plane and brighter colours should be further away from the axis. [4]

Colour perception

"Colour perception is connected to the capability of the eye to pass the incoming light through cornea, depending on the strength of the light." [1] In human eye there are more than 120 million rods and some 6-7 million cones. Rods are more sensitive than cones, but they are not sensitive to colour, they are only responsible for the perception of lightness of a colour. It is cones that detect colour, i.e. they are responsible for the perception of a tone of colour. There are three types of cones, each of them sensitive to different ranges of the visible spectrum. One type of cones corresponds to long wavelength that absorbs blue light, another type of cones corresponds to medium wavelength that absorbs green light and the third type corresponds to short wavelength that absorbs red light. According to Fairchild, adequate names for cones are L(Long), M(Medium) and S(Short). [5,6,7] The names refer to wavelengths at which colours are perceived by means of cones.
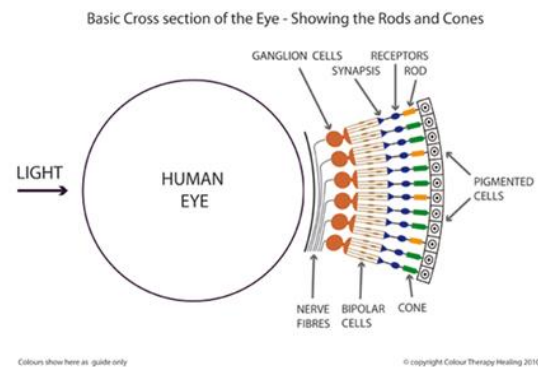

Figure 4: Colour perception by means of rods and cones [10]

When we observe colour with a wavelength between primary colours red, green and blue, combinations of cones are stimulated. As an example, yellow light stimulates the cones sensitive to red and

green light. The result is that we can perceive light of all colours in the visible spectrum. [8,9,11]

CIE chromaticity diagram

The colour of an object does not depend solely on the object itself, but also on the source of light, the colour of the environment and a person's eyesight. Colour perception is connected with the notion of light. Two basic groups are achromatic and chromatic light.

Achromatic light is perceived as black, white or grey colour, and their only attribute is lightness, i.e. the quantity of light. In terms of physics, the quantity of light corresponds to energy, and is described by means of intensity and luminance. In psychological terms this is described as a sensory intensity and is called brightness. It is advisable to define scalar value as a measure of intensity so that value 0 (zero) corresponds to black light, and value 1 (one) to white light. Between these two values there are different levels of grey.

Chromatic light is a source of much richer and more diverse visual perception. The perception of chromatic light is usually described by three values: hue, saturation and lightness. Hue describes the type of colour, whereas saturation is an indication of the distance of that colour from grey of the same intensity. For example, red is a highly saturated colour, whereas pink is less saturated. Lightness indicates the intensity of light reflected off the object. Sometimes the term brightness is used instead of lightness, especially when speaking of objects which are in themselves sources of light, such as lightbulbs.

The wavelengths used for colour comparison are Λ=435.8 nm for the blue spectrum, Λ=546.1 nm for the green spectrum and Λ=700 nm for the red

spectrum. The amounts of stimuli in the three parts of spectrum in the adopted units are called tristimulus values. From the tri-dimensional CE XYZ system of imaginary stimuli one can derive a two-dimensional way of representing certain colour characteristics within the CIE chromaticity diagram. Monochromatic light, i.e. spectral colours within the CIE chromaticity diagram are situated on the curve and on the edges of the diagram which is the extended part in comparison to the triangle X+Y+Z=1. Real colours are situated within the diagram in the triangular area of colours. The isoenergetic source of light (E) is situated in the centre of the triangle X,Y,Z. The lightness axis is vertical on the isoenergetic part of light. Complementary colours are situated so that they lie on the intersection of the straight line passing from the colour through the isoenergetic source of light (E) to the outer outline of the diagram. [3,5,12]
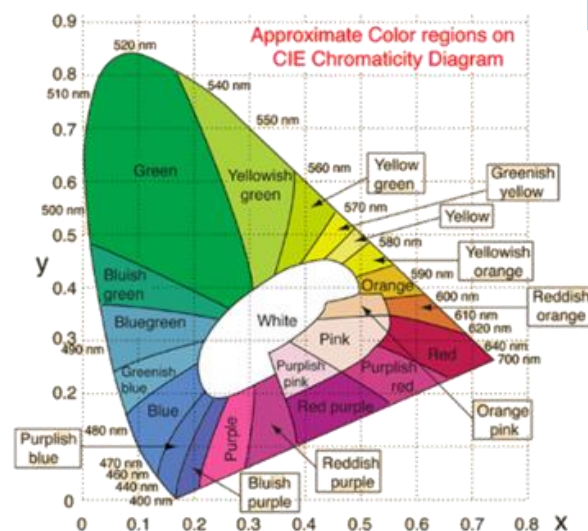

Figure 5: Chromaticity diagram [12]

Daltonism

Colour blindness or daltonism affects about 7% of men and about 0.04% of women. The most frequent form of daltonism is inability to

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differentiate red and green colour, which means that people suffering from this do not see these colours as other people. In a normal eye there are cones specifically for perception of red, green and blue, but people suffering from daltonism lack some of these cones. They are able to see the colour green outside in daylight, but the same thing might seem brown to them when they are inside.

There are several types of hereditary daltonism. A normal eye uses all three types of cones correctly, and these people are called trichromates. When there is daltonism, all cones receive light colours, but one cone perceives light slightly off the centre. Depending on which cone is erroneous, there are three different outcomes. These different aberrations are protanopia, deuteranopia and tritanopia. Protanopia is decreased sensitivity of the eye to the red light, deuteranopia is decreased sensitivity to the green light, and tritanopia is decreased sensitivity to the blue light. Deuteranopia is the most frequent form of daltonism. People with deuteranopia and protanopia have difficulties in identifying the differences between red and green, and brown and orange. It is also difficult to see the difference between blue and violet tones. On the other hand, people who can see the blue spectrum have troubles differentiating between blue and yellow, violet and red, and finally between blue and green. The last one is the rarest condition and affects equally men and women. There is also dichromatic daltonism. Such persons have only two types of cones which can receive colours, and the third type is underdeveloped. Unlike irregular trichromates, their perception of colour does not improve in daylight. Dichromatic vision can be hereditary. People suffering from protanopia are unable to perceive any red light, those suffering from deuteranopia are unable to perceive any green light, and those suffering from tritanopia are unable to perceive any blue light. People who cannot see properly red and green colour live in a world without colours blue and yellow. In both these conditions there will be mixing up of some blue and violet tones, and they will find it hard to differentiate light nuances of most colours. [13] The photographs below illustrate how different types of dichromates see colours.

Figure 6: Normal eyesight [14]

Figure 7: Deuteranopia [14]

Figure 8: Protanopia [14]

Figure 9: Tritanopia [14]

There are some specific differences between protanopia and deuteranopia. People with protanopia are more likely to confuse black with many nuances of red, dark brown with dark green, dark orange with dark red, some blue nuances with red, violet with darker pink, and green with orange. People with deuteranopia are more likely to confuse red with green, bluish-green with grey and medium pink, light green with yellow, light pink with light grey, red with brown, and light blue with lilac. There is also complete colour blindness or achromatopia, but this condition is very rare. People with monochromatic vision do not see any colours, and their world is painted in black and white and different shades of grey between these extremes. Achromatopia makes it difficult to function properly in everyday life, and such people in normal light conditions need to wear dark glasses. [13,14]

Colours and marketing

Colour is a valuable tool and an integral part of marketing communication, which can send powerful messages to consumers. Different research has shown that 80% of information that people retain is associated with colour.

The significance of colour follows us throughout our lives. Among human faculties or senses sight is the most dominant and developed one, and has the biggest impact on consumer perception. Some studies have shown that 60% of purchasing decisions can be attributed to the choice of an appropriate colour [15]. Colours can grab our attention, be relaxing or irritating. As in other life situations, the first impression is also crucial in marketing.

Given that a particular colour can have positive or negative associations in different cultures, one has to think carefully about the colours used in communication with consumers. When launching a new product, designers try to find the best colour to convey a certain message. Of course, it is not only the colour that is important, but an attractive design in general. Today's market is saturated with all kinds of products, and we are daily flooded with 3500-4000 marketing messages [16,17]. In such a situation it is not easy for any product to stand out. If you give consumers a choice of two equally priced products of the same type, they will inevitably choose the one which is visually more pleasing. On average, consumers need 1/20 to half a second to notice a certain product. Furthermore, studies have shown that purchasing decisions are made within 90 seconds. For this reason, it is important to choose a pleasing colour. In such a brief timespan the brain perceives only attractive colours and disregards the others. As consumers we should be aware whether we are buying a product because of its quality or because we really liked the packaging. [18,19].

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Design of the company Cridens

The logo design of the company Cridens is the redesign of former Dental Consulting. "A logo is a visual presentation of business identity on the market of information. The company or organisation sign and logo are the first thing to be noticed and the most memorable business asset. A professionally designed logo will establish an original business identity and communicate to your customers who you are in the world of information and symbols." [20]

The redesigned logo uses the same colours that were used previously, light blue and grey. Light blue creates a connection with medicine, which is part of the company's activities. Grey is suitable as it is associated with professionalism and creates a sense of trust.

The decision to rename the company and change its logo was taken because Dental Consulting was too long and also too closely connected with dental medicine. People were finding it difficult to remember the name, thus it was decided to shorten it and to create a visually more noticeable logo.

Figure 9: Dental Consulting [20]

Cridens

The logo of the company Cridens now comprises two sides of the brain, and the company name is written in the font Calibri, which was chosen as the company's official font.

Each side of the brain was first drawn separately in Adobe Illustrator. Taking into consideration that the company engages in different activities, the two sides of the brain are in different colours. On the one hand, the company offers logical solutions such as seminars and training courses, and on the other, it provides artistic solutions, such as web design and design in general.

The left side of the brain is grey with increased opacity, that is, transparency, because the company name is to be written over it. Opacity was increased in Adobe Photoshop in order to get a .png image.

Figure 10: Brain_1 [20]

The side of the brain on the right is light blue, or even of cyan hue. Transparency was again created in Adobe Photoshop and the image was saved as a .png file.

Figure 11: Brain _2 [20]

In the logo itself, the right side was moved slightly lower, to make the difference between the halves more noticeable. When the image was finalized and saved as a .png file, it was processed in Adobe Illustrator to increase its opacity, i.e. to make it

more transparent. Finally, from Adobe Illustrator the logo can be saved as a .pdf file which is then print-ready.

Figure 12: Logo [20]

The logo was also saved as a .png file so that it can be used in electronic documents. The logo shown in Figure 12 will be on the official stamp as well as printed on T-shirts, whereas the one shown in Figure 13, with added address and e-mail, will be used in official documents and invoices.

Figure 13: Logo for official documents [20]

Conclusion

The study of colours goes as far back as ancient Greece. Aristotle stated that blue and yellow were primary colours. As for human eye physiology, rods are more sensitive than cones, but they are not sensitive to colour, but rather to the lightness of a colour. Cones are the ones that detect colour, i.e. different tones of colour. If a person has an anomaly on one of the cones, or the cones are underdeveloped, this results in daltonism or colour blindness. More precisely, people with this condition cannot see the whole colour spectrum. Some colours seem too pale and they cannot identify the differences between them. Although possible, complete colour blindness is very rare. It occurs when cones failed to develop; the consequence is that such a person sees everything in black, white, and the grey nuances in between.

Most people can see colours, but they have different reactions to them. Thus, the colour red can stimulate aggression, but it is also a symbol of love. Blue creates tranquillity, but it can also be depressing.

Studies have shown that colours can influence people in both physical and psychological sense. This is why they are widely used in marketing. The colour of a logo is chosen to convey a desired message and to make it memorable. The logos of famous companies, such as Coca-Cola, are recognizable thanks to colour and particular design. This was the aim of redesigning the logo of Cridens in blue and grey tones - to make it memorable and create a feeling of safety and trust.

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