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A Comparative Study on Gender Based Alteration in Color Perception in young adults

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Abstract

INTRODUCTION: Sense of Vision is very important as about 80% of the information which we get through all the senses, is visual . This information become more meaningful and informative when these are colourful.

MATERIALS & METHODS: The study was carried on 60 ocular healthy subjects . They were divided in two groups .First group was having 30 male individuals while second group was having age matched 30 female individuals. Exclusion criteria was any previous or present eye and colour vision related problems.The task was to match 25 colour strips with 2 shade charts of different colours.

RESULTS: It was found that females gave more correct responses as compared to males and this difference was statistically highly significant

CONCLUSION: In human retina ,three types of cones are there:short wavelength (blue) sensitive cones,medium wavelength (green) sensitive and long(red) wavelength sensitive cones . Different wavelength of light stimulate this cones with different intensity. At the end we conclude that females can discriminate more shades of colors than males.

INTRODUCTION

Sense of Vision is very important as about 80% of the information which we get through all the senses, is visual [IV]. This information become more meaningful and informative when these are colourful. Colour vision is the ability of the eyes to discriminate between the light rays of different wavelengths. About 8% of men exhibit a hereditary deficiency of colour perception. Therefore this study was planned in a very simple and interesting manner to evaluate the color perception in two sexes of same age groups. Color vision is the ability of an organism to distinguish objects based on the wavelengths (or frequencies) of the light they reflect, emit, or transmit. Colors can be measured and quantified in various ways; indeed, a person's perception of colors is a subjective process whereby the brain responds to the stimuli that are produced when incoming light reacts with the several types of cone cells in the eye. In essence, different people see the same illuminated object or light source in different ways. Perception of color begins with specialized retinal cells containing pigments with different spectral sensitivities, known as cone cells. In humans, there are three types of cones sensitive to three different spectra, resulting in trichromatic color vision.Each individual cone contains pigments composed of opsin apoprotein, which is covalently linked to either 11-cis-hydroretinal or more rarely 11-cis-dehydroretinal[vi].The cones are conventionally labeled according to the ordering of the wavelengths of the peaks of their spectral sensitivities: short (S), medium (M), and long (L) cone types. These three types do not correspond well to particular colors as we know them. Rather, the perception of color is achieved by a complex process that starts with the differential output of these cells in the retina and it will be finalized in the visual cortex and associative areas of the brain. For example, while the L cones have been referred to simply as red receptors, microspectrophotometry has shown that their peak sensitivity is in the greenish-yellow region of the spectrum. Similarly, the S- and M-cones do not directly correspond to blue and green, although they are often described as such. The RGB color model, therefore, is a convenient means for representing color, but is not directly based on the types of cones in the human eye. The peak response of human cone cells varies, even among individuals with so-called normal color vision; in some non-human species this polymorphic variation is even greater, and it may well be adaptive.

MATERIALS & METHODS

The study was carried out in Aroma College of Commerce,Usmanpura,Ahmedabad on 60 ocular healthy subjects of both sexes between 18 – 22 yrs of age. They were divided in two groups .First group was having 30 male individuals while second group was having age matched 30 female individuals. Exclusion criteria was any previous or present eye and colour vision related problems.The task was to match 25 colour strips with 2 shade charts of different colours. The experiment was done at the same place for all the studests and the lighting conditions that were provided remained same for all the students. Total no. of correct answers and total time taken in matching all the test colour strips with shade charts was recorded in both sexes with the help of stop watch and analyzed. Mean and SD was calculated for both groups and unpaired t test was done to find out p value.

RESULTS

	Correct response (25 strips)	**Time taken (sec)**
Male(n=30)	21.30±1.70	429±75.29

Female(n=30)	23.00±1.49	330.43±64.38
	P<0.001*	P<0.0001**

*-Highly significant ** - Extremely significant

Colour Wise Correct Respon

Colour	Male(n=30)	Female(n=30)
Red	16	26
Green	21	28
Blue	28	27
Purple	27	27
Orange	24	27
Grey	27	29

RESULTS

Out of 25 test colour strips the total no. of correct response was compared in both males and females. It was found that females gave more correct responses as compared to males and this difference was statistically highly significant. Other than this females also took less time than males in matching all the colour test strips with the shade charts and this difference in duration was also found statistically extremely significant .

DISCUSSION

Color processing begins at a very early level in the visual system (even within the retina) through initial color opponent mechanisms. Both Helmholtz's trichromatic theory, and Hering's opponent process theory are therefore correct, but trichromacy arises at the level of the receptors, and opponent processes arise at the level of retinal ganglion cells and beyond. In Hering's theory opponent mechanisms refer to the opposing color effect of red–green, blue–yellow, and light–dark. However, in the visual system, it is the activity of the different receptor types that are opposed. Some midget retinal ganglion cells oppose L and M cone activity, which corresponds loosely to red–green opponency, but actually runs along an axis from blue-green to magenta[vii]. Small bistratified retinal ganglion cells oppose input from the S cones to input from the L and M cones. This is often thought to correspond to blue–yellow opponency, but actually runs along a color axis from lime green to violet.In this study female subjects showed statistically significant better matching of colours in comparison to their male counter parts and that also taking less time.In human retina ,three types of cones are there:short wavelength (blue) sensitive cones,medium wavelength (green) sensitive and long(red) wavelength sensitive cones . Different wavelength of light stimulate this cones with different intensity.Final outcome is amalgamation of these three types of cones. Physiological cause behind difference of the color perception in males and females is based on colour gene that is present on X-chromosome particularly for Red and Green [I]. As two X chromosome present in female creating opportunity for one type red cone to be activated on one X chromosome and other type of red cone on the other one. That may seen sometimes for green cone also. So, at the end we conclude that females can discriminate more shades of colors than males [III].

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