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A child is born and it doesn’t take long for mom and/or dad to start pointing out different things in their child’s environment. Parents give a name and a color to most things their child views…ex.-look at the brown dog, let’s play with the red ball, and there’s a green frog. It is amazing how we are able to associate different things in our surrounding to color but what if the colors you are naming are not the same colors the other person is seeing? This is definitely feasible due to color-blindness. Professor Baaird’s (1908) stated that color-blindness has nothing to do with naming colors, it’s about not seeing color the same as most people perceive color. (p. 297).

Before understanding color-blindness it is important to understand that color vision is a function of the brains ability to interpret the complex way in which light is reflected off every object. “ Perception of color is associated with the physical property of wavelength.” (Goldstein, 2010, p. 204). Red green, and blue are the three primary colors and each color reflects a particular wavelength. The eye works off of these three colors- meaning the retina of the eye picks up mixtures of these colors. Behind the retina are three photoreceptor cones (L, M, and S) which are responsible for different colors we see. Each cone is associated with one of the three primary colors through their wavelengths such as: red (long), green (medium), and blue (short). When a person is not able to reflect a particular wavelength then we understand one or more of the photoreceptor cones isn’t functioning (each cone reflects certain wavelengths- if a cone isn’t functioning then a person can’t reflect that particular wavelength.)

Color-blindness is the inability or reduced ability to see colors, or lack the ability to distinguish between different colors. Hunt (1995) explains James Dalton diagnosed himself in 1794 with color-blindness. (p. 984). Shepard (1992) explained that color-blindness has different levels, with some people lacking the ability to see any of the primary colors to others having difficulties in distinguishing two colors. (p. 97). There are different types of color-deficiencies; color-blind comes with the assumption that a person can't see colors which is why I have chosen to use color-deficiencies throughout this paper. Red-monochromatic (usually hereditary) is the rarest form of color-blindness and it is true to the word color-blind meaning a person doesn't see color they see in shades of black, grey and white. Goldstein (2010) explained " only about 10 people out of 1 million" persons have monochromatic. (p. 212).

Swanton (1997) stated " Color vision confusion (CVC), or color blindness, is thought to affect about 10 percent oftheworld's population." (p. 116). Common types of color-deficiencies are:

- **Anomalous trichromacy which is the most common type of color-deficiency. Is usually hereditary. Pigment in one of the cones (L, M, S) is not functioning normally. There are three different types:
    - *Protonomaly- (red-green) L cone is not functioning normally causing a hard time differentiating some shades of red/green.
    - *Deuteranomaly-(red-green) M cone is not functioning normally causing a problem distinguishing red/green. Most common type of trichromacy.

- Tritanomaly-(blue/yellow) S cone in not functioning normally causing a problem distinguishing blue/yellow. The rarest type of trichromacy.

*MD Francesco Luca (1960), reported “ genes encoding the red and green photo pigments are located on the long arm of the X chromosome, and red-green color vision defects are in fact inherited as X-Linked recessive traits.” (p. 443).

- Dichromacy means that one of the cones (L, M, and S) is not functioning.
    - Protanopia- there is no L cone causing severe effect in vision.
    - Deuteranopia- there is no M cone causing a more severe difference in viewing red/green.
    - Tritanopia- there is no S cone causing severe difficulties in viewing blue/yellow, blue/green, and yellow/violet.

**Information retrieved fromwww. colourblindness. com

Symptoms of color-deficiencies can vary from person to person.

As explained earlier some types of color-deficiencies are hereditary, others can be acquired and/or a birth defect. It is commonly believed that males are the only recipients of color-blindness and/or color-deficiencies which is incorrect; males are at higher risks for color-deficiencies due to the X-chromosome being the carrier. Females have two X-chromosomes which lowers their risks of receiving the one defective chromosome needed to inherit color-deficiency. Different ways of acquiring a color-deficiency can be multiple causes such as: accident/injury, vitamin deficiency, old age,

diseases, side effects of medication, environmental pollutants, and/or drug/alcohol abuse.

Colourblindness. org (n. d.) discusses two myths about color-blindness/color-deficiency in particular that seemed interesting which were: if you want to improve your eyesight eat more carrots sitting to close to the TV/computer can hurt your eyesight. Eating carrots might help with your daily intake of vitamins and help maintain your eyesight but they will not improve it. Sitting to close to a screen of any kind can cause dry eyes but it doesn't change your vision.

The most common type of test for color-deficiencies is the Ishihara plate test which is used to diagnose green and red color deficiencies. Patients are asked to stare at a selection of plates that have got colored spots. Each of the plates have a number with a different color that can easily be seen by people who have normal vision. Those with color-deficiencies are not able to see that specific number. Several online websites offer a version of the Ishihara test which allows a person to check for potential color-deficiencies.

There is no cure for color-blindness or color-deficiencies. Available in *New Scientist* (2013) *,* is an article which states " Glasses correct colour blindness" which is misleading due to the fact that the glasses allow a person with color-deficiencies to distinguish between two different colors. (p. 18). Several companies now offer an app available on phones that utilizes the phones camera and splits the screen in two sections- one side of the screen shows " normal" color-vision while the other side allows the user to view how persons with deuteranopy, tritansopy, and protanopy (color-

deficiencies) views the same picture. In *Accommodating Colorblind users in Image Search,* authors discuss three services search websites are doing to accommodate individuals with color-deficiencies which are 1) Prioritizing images based on search results for image quality 2) Change colors for perception purposes and 3) label a color to an object. (Wang, 2009, p. 840). The *International Journal of Studies,* retrieved from nature. com, gene therapy was used in two monkeys with color-deficiencies (red/green), after 20 weeks the monkeys were tested and their red/green vision had improved. Scientist are excited and hopeful but point out that it is early in the process.

Gordon (1998), stated " When it comes to the selection of a career it may well by essential to identify possible colour vision defects." (p. 83). Those diagnosed with color blindness/deficiencies may not be eligible to join certain careers such as the police and the armed forces. Many careers require perfect eye sight, which makes it important for one to carry out adequate duties. Color vision is vital for careers that use telephone and computer networking cables. This is because the specific wires within the cables are coded using yellow, blue, green, orange, and white.

Living with color blindness/deficiencies can cause frustrations due to we live in a world of color and perceptions relating to color. The yellow sun, the blue lake, the red/green apple are just a few examples of perception relating to items. Color vision problems can also cause learning disabilities and reading delays which is why it is detrimental to test kids' vision at young ages. Realizing a child has color blindness or deficiencies will not fix the problem but it allows the adults to assist the child with the deficiency while alleviating frustrations and possible delays.

Gordon (1998) discusses the importance of using tests with wavy lines to detect color blindness/deficiencies for children ages 4-ll years. (p. 82). I spent over ten years working with 300 children/year ages 3-5 during which I tested children on matching colors. The first year I struggled with the “ Ages and Stages” test, which was mandated by the state. To get children to cooperate, I began to use items (toys, fruit, cartoon characters, etc…) that children would be familiar with to match colors. It was obvious that when the children viewed the test as a game they seemed to relax and most were able to match colors. If a child was not able to match red/green or yellow/blue I immediately referred the parent/child to a specialist then with parents’ written consent we would make follow-up calls with parent and specialist 6 months and 1 year after the initial testing. By detecting color-blindness/deficiencies during the early primary years, it is possible to prevent many children from feeling “ stupid”, “ incompetent”, and/or “ different”. Early detection also allows professionals to educate parents along with offering coping skills to handle situations which may become difficult for parent and/or child in the present/future.

Color blindness and color-deficiencies definitely effect people on a daily basis. I don’t believe it is comparable to cancer or any other terminal illness/disease but it does have it side effects which can affect a person’s mental thoughts. Technological advancements have surpassed my mental capacities which helps me to believe that there could be a day that color blindness and/or deficiencies are no longer an issue for humans. I believe it is important to remember that not all people see color deficiency as disabling and they “ just because” technology is advancing as it is does not

mean that all persons' with color deficiencies (ex. Steve) will not choose to pay to be " normal".

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