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Barriers and Solution Suggestions for Colour Blind People in Sports and Recreation Areas

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Abstract

Color blindness is a disability that negatively affects human life and people with this disability are confronted in every aspect of life. Since this disease does not manifest itself physically, it cannot be perceived by healthy individuals and there is not enough awareness in societies to prevent this disability. It is important that activity areas and the objects used in these areas are adapted to color tones that color blind people can perceive. This deficiency is noticeable in many areas such as sports halls, sports competitions, recreational activity areas, TV and computers with visual interaction. The aim of this study is to pave the way for new studies by revealing the obstacles that colorblind individuals may encounter in sports competitions, passive and active recreation activities. In this study, which adopted a qualitative research design, document analysis was used as the data collection technique. Current approaches that can be applied are discussed in the light of literature information, and common problems encountered by colour-blind people and suggestions for solutions are presented. As a result, this situation has started to be taken into consideration in sports organizations in recent years and some steps have been taken in this regard, although not enough. In recreational activity areas, however, it is noticeable that this awareness is at a very low level.
Keywords: Color blindness, Recreation, Sport competitions.

Renk Körlerinin Spor ve Rekreasyon Alanlarında Yaşayabileceği Engeller ve Çözüm Önerileri

Öz

Renk körlüğü insan yaşamını olumsuz yönde etkileyen bir engel olup yaşamın her alanında bu engele sahip olan insanların karşısına çıkmaktadır. Bu hastalık fiziksel olarak kendini belli etmediği için sağlıklı bireyler tarafından algılanamamakta ve bu engelin önüne geçilebilmesi için toplumlarda yeterince farkındalık oluşmamaktadır. Etkinlik alanlarının ve bu alanlarda kullanılan nesnelerin renk körlerinin algılayabileceği renk tonlarına uyarlanması önem arz etmektedir. Spor salonları, spor müsabakaları, rekreatif etkinlik alanları, görsel etkileşimde bulunulan tv ve bilgisayarlar gibi birçok alanda bu eksiklik göze çarpmaktadır. Bu çalışmanın amacı, renk körü olan bireylerin spor müsabakalarında, pasif ve aktif rekreasyon faaliyetlerinde karşılarına çıkabilecek engelleri ortaya koyarak yeni çalışmaların önünü açmaktır. Nitel araştırma deseni benimsenen bu çalışmada veri toplama tekniği olarak doküman incelemesi kullanılmıştır. Literatür bilgileri ışığında uygulanabilecek güncel yaklaşımlar tartışılarak, renk körü bireylerin karşılaştıkları ortak sorunlar ve çözüm önerileri sunulmaktadır. Sonuç olarak spor organizasyonlarında son yıllarda bu durum önemsenmeye başlanmış ve yeterli olmamakla birlikte bu konuda bazı adımlar atılmıştır. Rekreatif etkinlik alanlarında ise bu farkındalığın çok düşük düzeyde olduğu göze çarpmaktadır.
Anahtar Kelimeler: Renk körlüğü, Rekreasyon, Spor müsabakaları.

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INTRODUCTION

Disability is a limitation and brings along a number of problems at every stage of life. The main ones are physical, mental and social problems. Society, institutions and lawmakers have important responsibilities in overcoming these problems. Although important improvements have been made in terms of the rights of the disabled today, some issues may be overlooked or ignored in the process of time in which people and society are constantly developing. This leads to a reconsideration of the concepts of equality and accessibility. Kudlick (2003) defined disability as a state of physical or mental deficiency that substantially limits basic life activities.

The United Nations recognized that the Universal Declaration of Human Rights does not provide adequate protection for persons with disabilities and adopted the Standard Rules on Equal Opportunities for Persons with Disabilities to provide policy guidelines to help countries better protect persons with disabilities. Since the Standard Rules are not legally binding, pressure has increased to improve the position of persons with disabilities in society and to create a legally binding convention on nations (Misener & Darcy, 2014). The Nations Convention on the Rights of Persons with Disabilities (CRPWD; United Nations, 2006) was created to address these concerns and recognize that people with disabilities have the right to access services in all areas of citizenship, including opportunities for recreation, leisure and sport.

People with disabilities often struggle with negative attitudes that prevent their integration into society. The general societal attitude towards people with disabilities is positive in verbal expressions, but in non-verbal emotions, people with disabilities are often rejected (Daruwalla & Darcy, 2005).

Discrimination against persons with disabilities is divided into direct and indirect discrimination. In direct discrimination, a person with a disability receives less (lower level) attention than a person without a disability. Indirect discrimination, on the other hand, is "a situation that arises as a result of conditions that people with disabilities cannot cope with and unfairly excludes them from equal participation in society" (Basser & Melinda, 2002).

One of the most common social problems faced by persons with disabilities is exclusion and ignorance. Accordingly, they are deprived of many rights, their claims for solutions to their current problems are characterized by the understanding of compensating for the damage and no steps can be taken for permanent solutions (Arıkan, 2002).

In social discourse, disability is the situation in which individuals who experience the disadvantageous situation created by activity limitations are ignored or considered to be of little value by contemporary social organizations, thus excluding them from the necessary participation in social life and maintaining their social activities (Barnes, 1998). The social factors to be considered in the definition of disability are need for care, employability, adaptation to social life, accessibility and accessibility (Öztürk, 2012).

One of these disabilities that affect human life is visual disability and color blindness is included in this disability class. Visual disability refers to complete or partial impairment or

loss of vision in one or both eyes. Examples include individuals using eye prostheses, color blindness and night blindness (Ceyhan et al., 2012; Çarkçı, 2011).

Individuals who suffer from colour vision deficiency may wear clothing or socks that do not match or face trouble distinguishing toothbrushes from each other. Furthermore, they encounter challenges with interpreting information designated by differently coloured highlighters, determining the charge level of their electronic devices, and reading maps. (Ananto et al., 2011; Skupien, 2013).

Colourblind people also face restrictions when choosing a job or career, and in some cases colourblind candidates are not offered jobs (Harwahyu et al., 2013). Their careers in the military, design and fashion industry may be hindered for this reason (Skupien, 2013).

Color blindness

Color blindness, which affects the ability to distinguish shades of color, is one of the most common genetic and inherited disorders in humans. (Aqtum & Qawasmeh, 2001; Naik & Pai, 2010; Rosenthal & Phillips, 1997). For color vision to occur, three types of photoreceptors in the cone cell must function properly (Gegenfurtner & Kiper, 2003; Parvizi & Frith, 2008). Impaired color perception occurs when one or more of the three types of cone cells that enable color perception are defective or missing (Zollinger, 1999). These disorders in the perception of colors are called "Color Blindness" or "Color Vision Disorder".

When it comes to color blindness, genetic color blindness is usually described. The color blindness gene is transmitted to generations via the Xq28 band on the X chromosome. (Rosenthal & Phillips, 1997). Men are more likely to be affected by colour blindness than women (Barrett et al., 2012). Around the world, almost 8% of men (Chacon et al., 2015; Lee & Dos Santos, 2010; Ohkubo & Kobayashi, 2008; Simunovic, 2010) and in about 2% of women (Iaccarino et al., 2006) color vision disorders are present.

Normal human color vision is the result of three different types of cone cells (blue, green and red) working in harmony. This type of normal vision is called trichromate color vision. If a person has only two cone cells for color vision and sees colors and their mixtures that can be perceived with these two cone cells, such color vision is called dichromatic color vision or dichromatic color blindness. Color vision with one color cone and no 2 color cones is called monochromatic color vision or monochromatic color blindness. There is also a color vision disorder in which no color cones are present (anopia) (Naik & Pai, 2010). Human colour vision is typically trichromatic, blending red, green and blue light. The most prevalent form of colour blindness results in difficulty distinguishing between red and green hues (Curcio et al., 1990).

Since color blindness is not a physically visible disease, individuals can live without their color vision defects being detected and, naturally, individuals may not even be aware that they have color vision defects. Individuals with this type may adapt to the environment in ways that suit them and may not even realize they have it. For example, for an individual with this condition, a very dark shade of red is the same as a few shades lighter. However, this condition affects the quality of their daily life even if they are not aware of it (Işık, 2017).

A number of tests are used to detect color blindness. The main ones are Ishihara test, Farnsworth Munsell's 100 Hue Test, D-15 Color Sorting Test, Anomaloscope, Holmgren Test, Lantern Test. Apart from these tests, there are also many computer-based tests.

The test commonly used to detect color blindness is the Ishihara test. The Ishihara test consists of many rounds of different sizes and colors with different colored palettes. Each colored palette contains a hidden number or a hidden line that only a person without color vision impairment can see. A complete test consists of 38 palettes in total (Bajcsy & Kooper, 2005). Although the most successful diagnostic method is the Anomaloscope, Ishihara color palettes are currently preferred instead of this test due to its very low applicability and high cost. (French et al., 2008).

It is noteworthy that there are few studies on this subject in our country. For this reason, it is not possible to determine how many people are affected by colorblind individuals compared to the population. (Semerkand, 1964) He applied ishihara color blindness test to 2120 female and 4010 male students in Balıkesir, İzmir and Ankara and found that 0.43% (9 people) of female students and 6.6% (265 people) of male students were color blind. (Teberik & Özer, 2015) 7% of young Turkish men have color blindness (Aydemir & Can, 2012) The prevalence of color blindness in men was 3.65%. (Citirik et al., 2005) conducted a study on congenital red-green colour blindness and tested 941 healthy male members of the Turkish army from different regions of Turkey. The results showed a prevalence of 7.33% for red-green colour blindness. Additionally, the researchers observed that the rates were higher than those reported in Mediterranean Europe and that regions with lower levels of education and higher rates of consanguineous marriages had a higher prevalence of colour blindness.

Sports and color blindness

Athletic performance is a complex phenomenon influenced by both hereditary (intrinsic) and environmental (extrinsic) factors. (Bayraktar & Kurtoğlu, 2009). Color blindness (color vision deficiency), which is a largely hereditary disease and affects approximately 1 in 12 men, means that in many team sports, at least one player in every men's team is color blind. From this point of view, there is an important problem that can affect the performance of colorblind athletes. The main problems that can affect performance are team uniform colors, field lines, all kinds of materials and materials used in the competition area.

On the field of competition, the lack of color distinction between team uniforms is problematic for both spectators and participants. This problem also arises in games where a moving target such as a ball is camouflaged by background colors, for example a brown soccer ball on a green playing field is often a confused pair (Israelski, 1978).

UEFA/FA/Color Blindness Awareness guide has informed federations about the need to be sensitive to this issue by preparing guidance for coaches, including information on the appropriate equipment to use and how to support colorblind players. The Turkish Football Federation highlighted this issue in its football development bulletin, Issue 11, under the title "color blindness in football".

Figure 1. UEFA/FA/Color blindness awareness guide, **(**Colourblindawareness, 2023)

Figure 1 simulates the colors seen by people with normal vision on the left and the colors seen by people with color vision impairment on the right. It shows the difficulties that a colorblind person can experience on the playing field or how it can affect the enjoyment of watching as a viewer on the screen. Although federations have warned about this issue in recent years, it is noticeable that the necessary sensitivity is not shown in some league matches and national competitions.

In the years when competitions were watched on black and white televisions, in a way everyone was colorblind. When people who are not colorblind watch these matches, it will help them understand what kind of disability colorblind people are victims of. In 1970, Adidas produced the first black and white soccer ball called "Telstar" for the Mexico World Cup. (Goldblatt & Williams, 2014). This color combination and contrast was visible on color and black and white televisions, compared to soccer balls, which were previously dominated by dark tones. In this way, it positively affected the viewing pleasure and experience of the viewers.

Tennis, which is played on a green field and uses yellow colored balls, can be given as an example as one of the situations where contrast is not created in color selection. Again, attention should be paid to the grounds on which sports such as basketball and volleyball are played to create a contrast to the ball used. In branches such as alpine skiing where slalom races are held, the choice of color used on slalom poles is important for both the athlete and the audience.

Given that eight percent of its audience may not be able to watch certain games due to color blindness, this potentially reduces viewing figures and therefore revenue. Sky Sports states that it is aware that the problems of jersey clashes and colorblind viewers are an ongoing issue for viewers both on television and at matches in person (colourblindawareness, 2023).

Figure 2. Substitution sign, (https://www.tv100.com, 2023)

When we look at the substitution signs, the extra time is shared with the players and the audience by using red LEDs on a black background. This is also often the case with scoreboards. Red numbers, letters or symbols on a black background can be very difficult for colorblind people to distinguish.

Recreation and color blindness

Disability is a condition where living space is limited and daily life is restricted. One of the key requirements for a sustainable society is that everyone can participate in everyday life independently, without discrimination, with everyone else, safely and actively. They can do this as long as the structural, social or digital environment they interact with is accessible, and they can expand their daily life spaces and boundaries only with accessibility. This is an urban right from a social perspective and is seen as an extension of the right to live in a world where it is enough just to be human (Ertan & Birol, 2013; Öner & Osmanoğulları, 2017; Tutal, 2019).

Colour blind people are part of society. Like everyone else, they actively or passively participate in indoor and outdoor recreation areas. In these areas, they may be indirectly discriminated against due to random colour choices. Wrong colour preferences can reduce the satisfaction from the activities.

It is important to make important accommodations for colorblind people in outdoor recreation activities. A colorblind participant may be in contact with poisonous plant or animal species due to barriers such as the inability to distinguish colors and to select different shades of the same color, which can lead to serious injuries. The responsibility in this regard falls on local authorities and organizations and recreation managers who organize activities in these areas. Participants should be informed about the presence or absence of color blindness during the pre-trip procedures and the necessary warnings should be given before the trip.

Lack of normal color discrimination can be a problem for outdoor enthusiasts such as campers, hikers or kayakers, especially if the person has reactions to poison ivy or other potentially offensive "color-coded" plant or animal life. Camouflaged animals can make hunting difficult, especially for color anomalies. More importantly, bright red hunting gear may not always be noticeable from a distance for colorblind sportsmen (Israelski, 1978).

Passive recreational activities are activities in which people participate and perform visual activities, are not involved in the activities but are followed from the outside. In these activities where the act of watching takes place, participants with color blindness can sometimes be deprived of the pleasure of watching. This is due to the fact that the clothes, pictures, writings, signs, lines, warnings and all kinds of materials and symbols used in the activity are randomly preferred without choosing contrasting color groups that color blind people can easily distinguish.

Some color contrast combinations used in film subtitles, for example, red on yellow or brown on green, are not noticeable to everyone. Problems in this area are often annoying but not serious, as noted by participants (Israelski, 1978).

Figure 3. Trail running, (http://www.geyikkosulari.com/tr/geyik/patika-kosusu, 2023)

People with colour blindness are often overlooked in the design of wayfinding signage, despite the increasing emphasis on universal and inclusive design principles that require ensuring equal access to information for all people (Wong, 2011). As people with colour blindness cannot distinguish some colour combinations, it is critical to avoid these colour combinations in wayfinding signage (Lee et al., 2020).

When Figure 3 is examined, we see that red colored flags are used in the forest dominated by green colors. Directional signs used in activities in natural areas can cause people with color vision impairment who participate in the activity to take the wrong paths when the color selection is not made correctly. Triangular flags, colored wooden signs, ribbon ribbons and warning strips should be created in color tones that people with color vision impairment can easily distinguish.

In places where events such as stadiums, concert areas, theaters, cinemas, indoor sports halls are organized, the colors to be used while preparing seating plans should be carefully selected and posters or tickets that can be easily understood by colorblind people should be prepared not only by coloring but also by supporting them with letters or numbers. In areas where colors are frequently used such as banners, tickets, seating plans and field maps, people who do graphic design work should be informed about this issue.

Figure 4 shows a poster showing the ticketing and seating plan in the concert area. A colorblind person will have difficulty in choosing the desired seat comfortably by moving from colors when buying a ticket. When the seating plan is not only composed of colors but also

supported with letters and numbers, seat selection will become easily accessible for colorblind people.

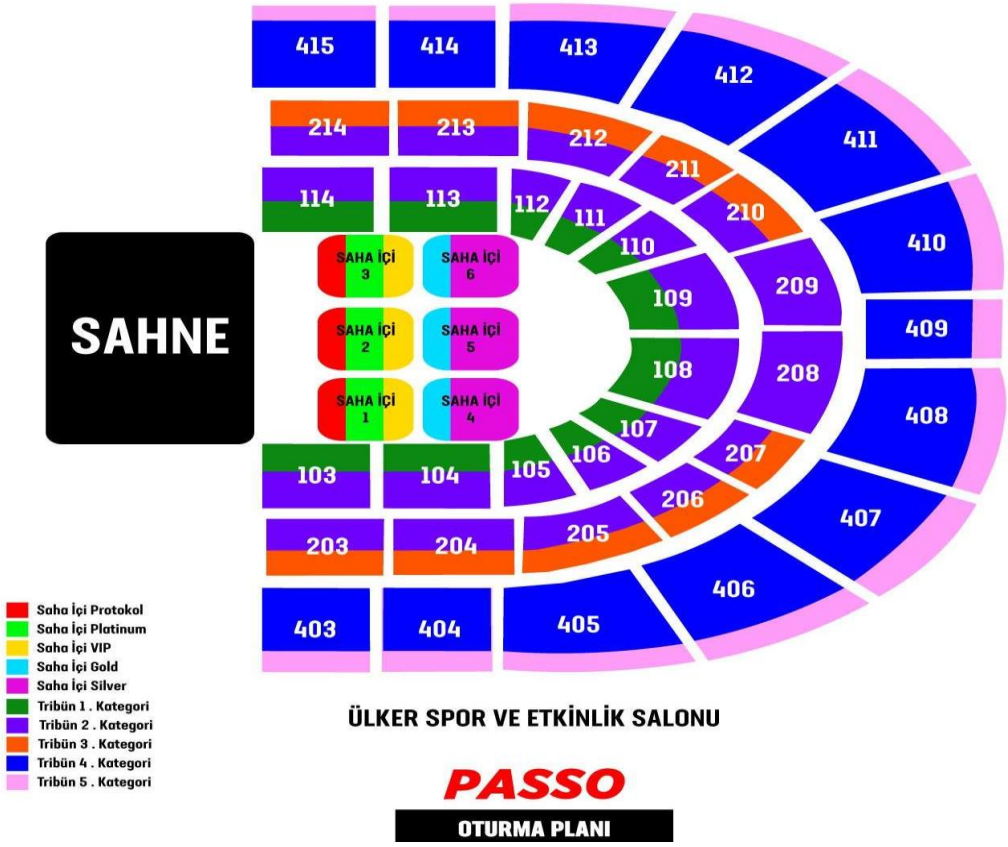

Figure 4. Ülker Arena seating plan, (https://www.passo.com.tr, 2023)

(Lee et al., 2020) proposed colour combinations for wayfinding signage that are distinguishable and aesthetically pleasing for people with and without colour blindness using a simulation method.

Fighting Color Blindness in Sport

It is known that important initiatives on the sociology of disability started in the 1970s in England. In the UK, the issue of disability, which was primarily addressed from a medical perspective, soon began to be discussed from a social perspective that criticized the medical perspective. In particular, the quantitative increase in the number of people with disabilities has brought attention to this issue, and this trend has brought discussions on disability to the forefront in other European countries (Burcu, 2015). Organizations that draw attention to the problems experienced by color blind people with color vision impairment in sports fields or as spectators have emerged in the UK.

In 2010, "Color Blind Awareness", a non-profit non-governmental organization established in the UK to raise awareness of the needs of color blind people in society, prepared the first guidelines on color blindness in 2017 with UEFA / British Football Association. It has also worked closely with World Rugby to deliver its guidelines on colorblindness in 2021. It provides advice and undertakes guidance and audit services to regulate the security of the most

high-profile stadiums in Europe. It was also created to verify the prevalence of color blindness in footballers at different levels of the game, identify barriers to progress and inform policies for the futu. Co-founder of the Tackling Color Blindness in Sport (TACBIS) project funded by EU Sport (colourblindawareness, 2023).

In 2019 the EU funded project Tackling Color Blindness in Sport (TACBIS) was created. The mission of TACBIS partners is to make sport accessible for people with Color Vision Deficiency. The problem of color blindness in sport concerns not only spectators but also players, coaches and various other stakeholders. Problems with color blindness are not limited to elite sports, there are many barriers in grassroots sports as well. Not taking color blindness into account can affect a player's performance or spoil the enjoyment of watching a live match. It can also create commercial problems when colorblind people turn away from their favorite sport in frustration, are unable to purchase tickets and merchandise independently, or cannot see sponsors' logos or advertising information (Tacbis, 2023).

Safety and color blindness

The number of people with color blindness is too large to ignore. Around 40 million people with color blindness in the UEFA confederation area and more than 300 million worldwide are affected (Tacbis, 2023).

As well as enjoying the event as a player or spectator, there are also safety issues to consider. Colour is an ideal element to make signage stand out when quick and easy navigation is a priority. Where visual clutter is to be minimised, signage should complement the surroundings (Calori & Vanden-Eynden, 2015). People with colour blindness claim that wayfinding signage creates difficulties for them (Skupien, 2013).

In a stadium, safety warnings and safety information should be easy to identify for all spectators. Spectators who need to evacuate in an emergency should be able to see the exit signs clearly. For this, emergency signs should be prepared in easily recognizable tones, taking into account colorblind people. The places where fire extinguishers are left should be painted in a way that contrasts with the color of the extinguisher. Wet floor signs are also one of the issues that need attention.

CONCLUSION and RECOMMENDATIONS

Colourblind people should be able to access recreational activities and sports organisations without being disadvantaged, without anxiety and without experiencing insecurity or potential unintentional discrimination, and awareness needs to be raised to eliminate this barrier.

The key to making recreation and sport activities safe and accessible for people with colour blindness is to make the right colour adjustments in these areas. The knowledge of sports managers and recreation leaders to answer questions such as how to use the right colour in

activity areas, how to create contrast between colours, how does the activity area look from the eyes of colour blind people will minimise the mistakes that can be made.

A "suggestion box" should be placed in the indoor and outdoor areas where the activities are held and feedback should be provided about the troublesome situations that colourblind people can identify. A focus group consisting of colourblind employees should be formed to intervene in areas that may constitute an obstacle.

Safety can become an issue, especially at large events. Given the large number of colourblind people who may attend, it is necessary to be aware of and take precautions in advance for internal and external factors that may affect crowd control or safe evacuation procedures. In emergency situations, if a colourblind person cannot easily understand a colour-coded map, this can have serious consequences. Areas such as direction signs, exit signs, direction lines, emergency boards, early warning warning buttons, fire extinguishers, warning lights, electrical panels, etc. created for evacuation areas should be adapted to colour tones that colour blind people can easily notice.

Maps and signage with indoor and outdoor wayfinding information are often based on colour coding. However, information presented in this way can often cause problems for colour blind people. When preparing these maps, attention should be paid to the use of contrasting colours, as well as numbers and letters. It will be effective in preventing these problems if the designers who design the maps and signs that go through the graphic design process have knowledge on this subject.

Colourblind athletes should be able to play and train as part of a team. For this purpose, the playing fields, the training materials and the various equipment used on these fields should be adapted to shades that colourblind people can distinguish by selecting the appropriate colour scale.

Colorblind fans face many challenges when trying to watch sporting events. These problems are primarily caused by jersey clashes, where both teams' jerseys appear the same colour. This situation reduces the pleasure of watching and the satisfaction obtained from the event. Each federation must review the necessary regulations on this issue, prepare an action plan and close the deficiencies in implementation.

Club or websites, ticket purchasing portals and product labels should be designed using the correct color scale. These problems can cause color blind people to stop purchasing services or products, as well as have a commercial impact.

If sponsors and advertisers do not use colours in tones that colour blind people can distinguish in the visuals used by sponsors and advertisers before, during and after the competition in the areas where sports organisations are held, they may not reach the entire target audience. This situation will be reflected as a negative return in terms of brand promotion and economic sense.

Brand image and social responsibility projects have an important place for sponsors. Considering that approximately one person out of every ten people is colour blind, it can be said that conducting advertising activities at a level that will create awareness that brands care about colour blind people will positively increase sympathy and loyalty towards that brand.

Clubs, associations and federations carrying out training activities on color blindness awareness, taking precautions against potential dangers, paying attention to the feedback and suggestions of color blind stakeholders and participants, and implementing the decisions taken as soon as possible will make significant contributions to eliminating this obstacle in sports fields.

It should be remembered that people with disabilities have the right to access services in all areas of citizenship, including opportunities for recreation, leisure and sport. The review and implementation of necessary measures, training and regulations by public institutions, local authorities and private enterprises in all areas of public concern, including colour-blind citizens, will further consolidate the foundations for a life without barriers.

Determining the difficulties experienced by colorblind athletes during the competition according to their branches, to what extent the colors preferred in the playing field lines, jerseys and game materials affect the athlete's reaction during the game;

How the color preferences used in billboards and ticketing affect the purchasing preferences of color blind people,

How much color preferences affect the level of satisfaction obtained from the activity in recreational activities attended as a spectator,

The effect of colors preferred on the reaction time of color blind athletes in visual-based branches such as e-sports, where reaction time is very important,

Determining the color blindness status of referees and investigating the evaluations of color blind referees regarding color confusion that may affect their decision-making during the competition,

It is thought that studies on the role of color blindness in the development of play-age children and on such issues will make positive contributions to overcoming obstacles as well as increasing awareness of color blindness.

Publication Ethics: During the preparation and writing process of this study, the scientific, ethical and citation rules within the scope of the "Directive on Scientific Research and Publication Ethics of Higher Education Institutions" were followed; no falsification was made on the collected data and this study was not sent to any other academic publication environment for evaluation.

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