The Azki Kit for Dark Viz Ultimate Frisbee Male Athletes with Reduced Visual Fields

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Contextual Review & Concept Statement

The Azki Kit was designed for elite male athletes with visual impairment competing in Dark Viz ultimate frisbee. Dark Viz is a future-thinking sport created for adaptive athletes and is an offshoot of ultimate frisbee. It is played in the evening to optimize cool temperatures and lighting conditions. Visual impairment (Figure 1) can be due to impairment of the eye structure, optical nerve, optic pathways, or visual cortex (International Paralympic Committee, 2018). The Azki Kit is designed for athletes with a visual field limited to less than 20 degrees in radius, whereas full vision would be approximately a 120-degree visual field radius. Individuals with visual impairment have an increased quality of life when they are involved in sports activities (Ilhan et al., 2021). In the United States, over 12 million people are visually impaired, and it is estimated that 93 million adults are at high risk for serious vision loss (CDC, 2020). With a reduced visual field, high contrast and unique colors are needed to distinguish between players. The kit focuses on visibility via LED illumination, mobility, and thermoregulation to allow athletes with reduced visual fields to compete at the highest potential.

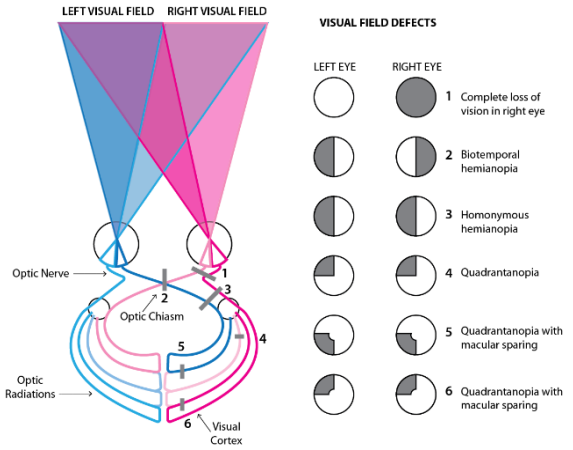

Figure 1. Shows visual field and possible visual impairments (Garrity, 2020).

Aesthetic Properties & Visual Impact

The goal of the Azki Kit was to optimize athlete visibility, allow for identification of player orientation, and provide thermal comfort. To maximize visibility of the athletes, the kit was crafted in high-contrast colors (e.g., black fabric base with vibrant blue LED light strips). To allow recognition of player orientation and body language, the LED lighting was strategically placed on the coronal plane so the front and back of each player could be identified, as well as on the lateral sides of the legs and circumference of the limbs so motion of the players could be seen. To provide thermal comfort at night, mesh panels made of dark blue spacer mesh were incorporated to promote ventilation in high sweat zones. These panels have similar angles to the LEDs to connect aesthetically throughout the uniform.

Process, Technique, & Execution

Using flat pattern drafting methods, five top and four bottom prototypes were developed before constructing the final uniform. Each round of prototyping explored shoulder mobility, fit, ventilation, and lighting placement. The top has fitted, short raglan sleeves and sits at hip length. It allows for shoulder mobility and keeps the torso covered when extending the arms upwards.

The top was made from a mid-weight 97% wool, 3% spandex jersey knit. This material was chosen because wool has excellent thermoregulation properties and spandex allows the material to stretch as the body moves (Woolmark | Wool Is Naturally Breathable, n.d.). The bottoms are a looser ¾ length silhouette to protect the legs from turf burn. These were made from 84% polyester, 16% spandex interlock knit. The bottom material differed in fiber content because the polyester allows for lightweight performance with a low friction hand that provides a sense of quickness on the field. All seams were stitched with a serger, and each ventilation panel was topstitched down so it laid flat against the athlete's body. The LED lighting strips were cut to length, crimped to quick connectors, and topstitched on as well. Bemis heat transfer film overlays were applied at each LED lighting strip connection point so the garment could be slit with an Exacto knife and allow for discrete wire routing. Finally, 3D-printed TPU ridges, which prevent turf burn by increasing padding between the body and the field during sliding, were applied below the lateral side of each knee. The ridges are currently handstitched but could be directly printed onto the fabric in the future.

Cohesion

The goal of the Azki Kit was to assist visibility, improve mobility, and increase thermoregulation of Dark Viz athletes with reduced visual fields so they can perform at their highest potential. This goal was achieved using high contrast colors and lighting to amplify visibility, a raglan sleeve and looser ¾ length bottoms with stretch materials to provide mobility, and strategic ventilation and sweat wicking materials to promote thermoregulation. Athlete feedback regarding the kit was positive, with highlights being the comfort and high visibility.

Significance, Rationale, & Contribution

Integration of LED lighting into clothing is becoming increasingly popular (Cheng et al., 2009). Using this technology to increase the quality of life of those with vision impairment has significant potential for other athletic and non-athletic apparel.

Originality & Innovation

The Azki Kit for Dark Viz is visually interesting, is designed for an underserved population, and considers the needs of ultimate frisbee athletes. The most unique feature is the incorporation of flexible, LED lighting. In the future, the design would incorporate an LED number designation, headband, and wristbands (Figure 2) to allow for individual player identification, better assessment of where the whole body is in space, and hand signaling. The lighting would also be solar powered to reduce the energy burden.

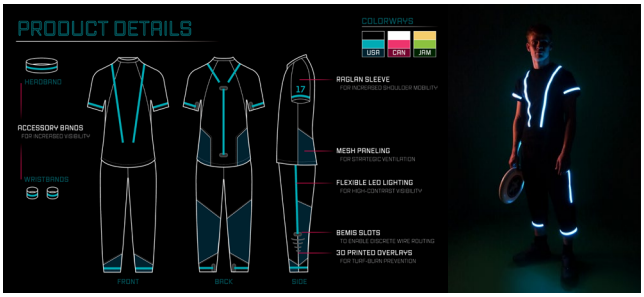

Figure 2 (left). Azki Kit tech flats. Figure 3 (right). Garment in low-light environment.

Reference

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