

# Assessment of Illuminance and Perception of Red/Green Polychromatic Light Compared Against White, Red and Blue Light

Jason M. Corless, MS, OMS-III; Bradley McCann OMS-III; Chris Calvano, MD, PhD; Anthony LaPorta, MD; Robert W. Enzenauer, MD, MPH, MSS, MBA.

## OVERVIEW

The purpose of this study is to investigate the perception of various hues of tactical lighting by enemy combatants in Special Forces medicine. White, red, blue, and red/green lights were compared.

## INTRODUCTION

From a tactical lighting perspective, there are three major components that contribute to success in Special Operations Forces medicine (SOFMED) under nighttime conditions. The first is maximizing visual capability; a red-green light-emitting diode (LED) has been shown to best meet this component.<sup>1</sup> Second, an ideal light source should allow for quick adaptation back to a dark environment after the light is turned off for preservation of night vision. The third essential consideration is to prevent detection of the medical personnel by enemy combatants in order to avert compromising the provider or casualty in the field.

This study focused on the third component and aimed to test the hypothesis that red/green polychromatic light had a greater threshold for detection over distances compared against white light, characterized by decreased illuminance with reduced potential for perception.

## METHODS

The FirstLight T-MAX LE (Tomahawk Light) was used as the source of the white, red, blue, and combined red/green light. (Figure 1) For our purposes, the illuminance of each colored light was measured at 55 cm. The distance of 55 cm was chosen arbitrarily as a means for comparison of the different light sources. (Table 1)

A direct comparison was made as to which light option was more readily detectable by potential human enemies. Twenty-two healthy medical students served as subjects and simulated the light-perceiving enemy.

Subjects were brought into a dark environment and were allowed one to two minutes for their eyes to adjust. Subjects were placed behind and at an angle from a doorway as depicted in Figure 2. The light source was then brought towards the subject slowly from the other side of the doorway at a 45° angle. The subject was asked to verbally identify the moment when they first perceived the light coming through the doorway. When the light was



Figure 1: FirstLight T-MAX LE (Tomahawk Light)

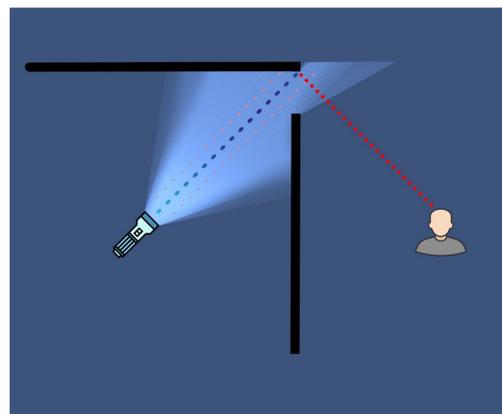
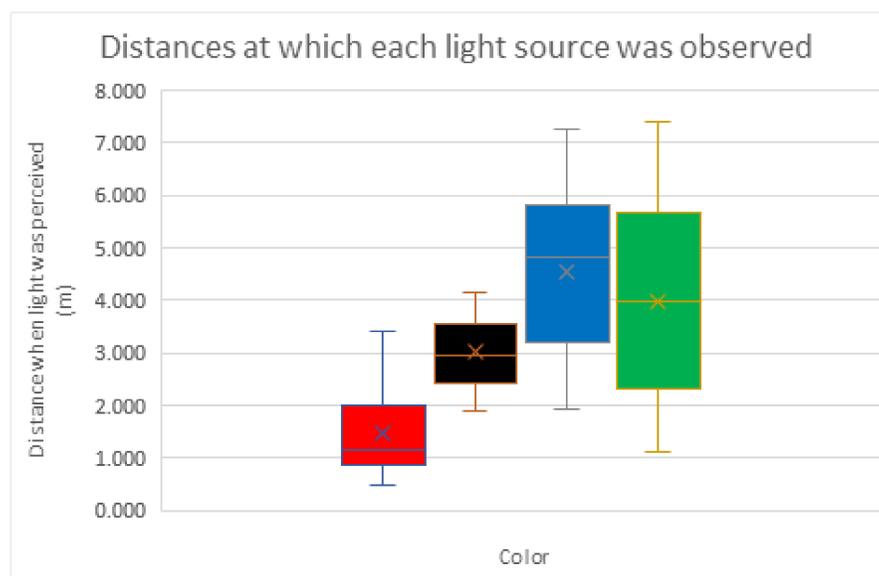


Figure 2: Experimental Setting. The blue line represents the distance measured.

Light Color	Illuminance (lux)	Illuminance Relative to White Light
White	510.0	1
Red	11.0	0.022
Blue	24.1	0.047
Red/Green	24.3	0.048

Table 1: Illuminance of various hues



Graph 1: Box and Whisker Plot of perceived distances

perceived, the light source was stopped and the distance from the doorway to the light was measured in meters as a means of comparing when each different light was perceived. Greater measured distances correlated with an easier perception of the light. Smaller measured distances meant that the subject had to be closer to the light in order to perceive it. Each subject was tested with white, red, blue, and red/green light. Time was given in between each trial for the subjects' eyes to adjust back to the dark environment.

## RESULTS

The mean distances at which the white, red, blue, and red/green light were perceived were 3.011±0.677 m, 1.458±0.811 m, 4.540±1.541 m, and 3.990±1.891 m respectively (Graph 1).

It was found that red light was the most difficult to perceive from a distance, followed by white light. The blue and red/green lights were found to be statistically equal in their perception and were more easily perceived than red and white.

## DISCUSSION AND CONCLUSIONS

Recent studies have concluded that polychromatic light sources such as red/green/yellow and red/green are superior sources of light compared to colored (nonwhite) monochromatic light sources for the purpose of maintaining visual acuity and color-vision perception.<sup>2,3</sup>

This study examined the detection of light from enemy combatants. When considering this aspect, red light would be recommended for routine operations due to it being the most difficult to perceive from a distance. However, based on earlier studies,<sup>2,3</sup> the improved performance in combat casualty care when using red/green light may outweigh its increased perceptibility by the enemy. More research is needed to investigate the perception of light in realistic tactical environments rather than in a controlled laboratory setting.

## REFERENCES

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