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ASSESSMENT OF COLOR-DEPENDENT VARIATIONS IN VISUAL CHOICE REACTION TIME AMONG YOUNG ADULTS

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Abstract

Background: The present study aimed to assess visual choice reaction time (VCRT) for different colored light stimuli. **Materials and Methods:** After providing adequate practice, VCRT was recorded for red, green, yellow, and blue light stimuli in young adults with no known visual impairment. Data has been recorded for three times, and the average value was considered. Data were expressed as mean ± standard deviation (SD)**,** and a P-value < 0.05 was considered statistically significant. **Results:** The results showed that the mean reaction times for yellow and blue stimuli were significantly longer compared to red and green stimuli (P < 0.05). **Conclusion:** The findings suggest that mental processing time varies depending on the color of the visual stimulus**,** indicating differential neural processing of color-based visual inputs.

Key words: Visual, choice, reaction time, red, blue, color

Introduction:

Reaction time (RT) is a secondary indicator of the skill of the central nervous system to determine one's sensory and relationships and related functions.[1] It is the elapsed time between the presentation of a sensory stimulus and the initiation of successive communicative response.[2] It is usually expressed in milliseconds. It reflects the state of health as well as neuromuscular coordination of an individual essential in daily life for the effective execution of mental actions, decision-making, processing and taking decision which are necessary for driving, physical skill and social activities that require attention for alertness and prompt decision-making. [3-8] It can be studied by using visual inputs called visual choice reaction time using four colors red, green,

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yellow and blue. [9] This test has a physiological as well as a clinical significance, as it has been found that several disorders like diabetes and hypothyroidism prolong RT can affect the professional life as well. [10-12]On the other hand, reaction time indicates the attentiveness of a person should be shorter for certain professions such as drivers, pilots, military men, sportsmen, doctors and security guards wherever awareness is essential. [13]

Aim and Objectives: The aim of this study was to compare the visual information processing speed choice and recorded visual choice reaction time for red, green, yellow and blue colors as well as metal processing time for those colors.

Materials and Methods

This study, approved by the Institutional Ethical committee, AIIMS, Bhubaneswar, was carried out in the Department of Physiology, AIIMS, Kalyani, West Bengal, India. 100 visually normal young adults (18-35 years) both male and female, signed the participant consent form and filled up participant information sheet including personal history, medication, drug addiction, history of injury specially brain and food habits. Anthropometric measurements such as age, height, weight, BMI (Body mass index) were taken. The parameters were recorded after adequate practice was given. Reaction time apparatus INCO (ISO9001:2000 Co.), with accuracy of ±0.001 sec, has been used for the recording of visual choice reaction time. There were four switches for four different colors light on both the sides. The switches on the experimenter's side were used to turn on the lights, while the switches on the subject's side were used to turn off them off. First, the visual mode was selected and any one of the four lights was turned on. The subject was asked to press the stop button as quickly as he/she could. Values were recorded three times for each colored light, and data were summarized using descriptive statistics: mean and standard deviation. All analyses were done using SPSS software version 17. P-value of < 0.05 was considered statistically significant.

Results:

In the present study, the demographic parameters age, height and weight were statistically significant when compared between genders but BMI was not significant (Table 1). The visual choice reaction time for the colors was compared using ANOVA, it showed in milliseconds for red, green, yellow, and blue were statistically significant with P value < 0.05 (Table 2). We

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found a longer reaction time for blue color compared to red, green and yellow colors stimuli and reaction time was shortest for red, compared to all other colors (fig 1). Females showed longer reaction time than males for all color stimuli (Fig 2).

Table 1: Showing the statistical values of demographic parameters among individuals.

Anthropometric parameters	Mean ± SD		P Value
	Male	Female	
Age (year)	23.14±1.03	23.3±1.388	0.001
Height (cm)	172.04±0.282	158.04±0.282	0.001
Weight (kg)	67.22±10.531	48.86±4.973	0.001
BMI (kg/m^2)	21.27±3.496	22.9727±3.589	0.07

Table 2: Showing the mean ± Standard deviation (SD) value of visual choice reaction time for red, green, yellow and blue colors stimulus.

Visual choicereaction time	Mean ± SD		P Value
	Male	Female	
Red	0.282±0.001	0.295±0.001	< 0.05
Green	0.286±0.007	0.292±1.121	< 0.05
Yellow	0.296±2.42	0.298±0.001	< 0.05
Blue	0.298±0.001	0.302±2.803	< 0.05

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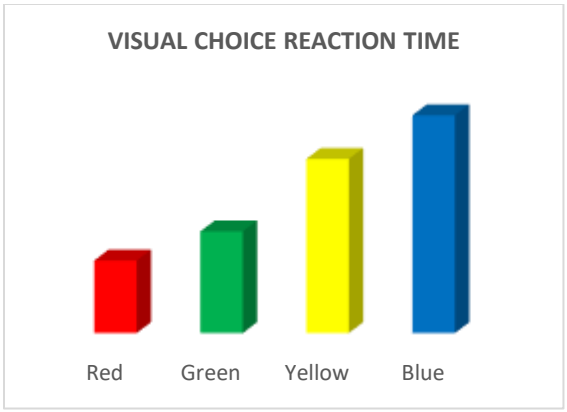

Fig 1: Comparison of visual choice reaction time followed by the red, green, yellow and blue colors light stimulus.

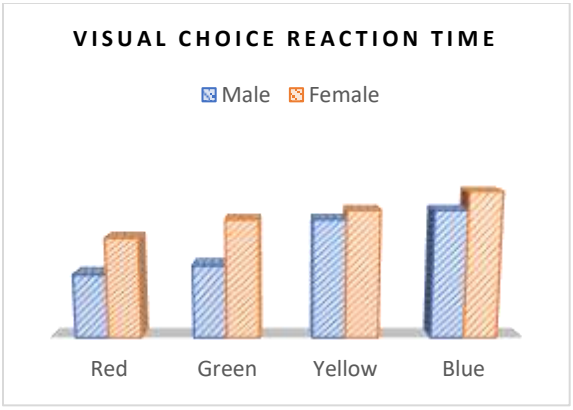

Fig 2: Comparison of visual choice reaction time of red, green, yellow and blue colors light in male and female.

Discussion:

The present study found the maximum and minimum mean reaction times for blue and red light stimuli, respectively. It also found that the average reaction times for green and yellow were intermediate between blue and red. The results of this study indicated some discrepancies with previous studies, while also aligning with other studies. [14-16]These studies showed that reaction time is shorter for red and longer for blue color stimuli. This may be because, when the retina is illuminated, microelectrode penetration into single cones activates the maximum number of cones for red, followed by blue. The shorter reaction times of red light compared to blue light can be explained by the number of light-sensitive photoreceptors responsive to different colors

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and the trichromatic theory, which suggests that different photoreceptors have varying levels of sensitivity. [17] The purpose of our study was to compare the visual choice reaction time for red, green, yellow and blue colors. Hence, we can say that gamma-band synchronization is better for red and green colors when compared with yellow [18] and blue. The study found that the mean visual reaction time for blue light stimuli was longer than the other stimuli. A probable reason may be that signal processing time in the S-cone system is longer than in other cone systems, so additional stimulation is needed to perceive the blue light. [19-20] Therefore, mental processing time is longer for blue light stimuli than other light stimulus. We also recorded longer reaction times in females than in males for all colored light stimuli, which may indicate possible neurophysiological or hormonal influences on sensory-motor coordination.

Conclusion:

Mental processing time is longest for blue and shortest for red color stimulus. The responses to visual stimuli of different colors varied, which be due to multiple contributing factors. From traffic lights to touch screen responses, color matters. Understanding how quickly we respond to visual cues can shape smarter designs in daily life, education, and professional training. These insights have meaningful applications in areas where rapid decision-making is important such as driving, aviation, and emergency response. The color-dependent variability in reaction time may also inform ergonomic design, traffic systems, sports training, and cognitive assessments. Ultimately, this study reinforces the idea that our perception of color is more than just visual; it is closely associated with cognitive processing, cortical arousal, and neurobehavioral responses. Increased awareness is necessary for both social and professional life.

Conflict of Interests: The authors declare that there is no conflict of interests for this publication.

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