

**UNIVERSITI TEKNOLOGI MARA**

**COLOUR, CONTRAST, POLARITY  
AND AMBIENT ILLUMINATION  
ELEMENTS: THEIR IMPACT ON  
VISUAL RESOLUTION  
MEASUREMENTS**

**NURULAIN BINTI MUHAMAD**

Thesis submitted in fulfillment  
of the requirements for the degree of  
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## AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student : Nurulain Binti Muhamad

Student I.D. No. : 2014433656

Programme : Master of Health Sciences (Optometry) – HS768

Faculty : Health Sciences

Thesis : Colour, Contrast, Polarity and Ambient Illumination  
Elements: Their Impact On Visual Resolution  
Measurements

Signature of Student :  .....

Date : February 2020

## ABSTRACT

The current world of technology, countless text/background designs are being applied in our daily life to help in information retrieval. The limit of text/background legibility and visibility are determined by the properties of different elements such as colour, contrast, polarity and ambient illumination. These elements have influenced the resolution of fine details that are responsible in ensuring that objects are highly legible and visible. This study aims to investigate the effects of colour, contrast, polarity and ambient illumination elements to measure visual resolution. The effects of colour, contrast, polarity and ambient illumination elements measuring visual resolution were examined in a series of investigations. The dependent measure was the logarithm of the minimum angle of resolution (logMAR unit) using four-orientations Landolt C chart. All the studies performed involved 31 participants. The first study compared the effects of text-background colour. While the second study compared the effects of contrast (colour and luminance contrast), where both these elements were further investigated to assess the interaction between colour and luminance effects. The third study assessed the effect of polarity. The last study examined the effects of ambient illumination in the presence of two types of glare sources (halogen and high-intensity discharge lamp) positioned to the left of the Landolt C within 15° radius (5°, 10°, 15°). Upon collecting all the information, the one-way repeated-measures ANOVA was used to compare the effects of colour. Effects of contrast were assessed using the paired sample t-test and simple linear regression. The 2 x 3 two-way repeated-measures ANOVA and one-way repeated measures ANOVA were both used to determine the effects of polarity. Lastly, the effects of ambient illumination were compared using the one-way repeated-measures ANOVA. Based on the findings, visual resolution measurements were significantly reduced with short-wavelength background colour, while the effects were identified to be worse when colour was applied in the text. Further analysis of the interaction between colour and luminance contrasts indicated higher variations in the visual resolution measurements with the colour element (43%) than the luminance element (63%). Higher variations depicted poor logMAR. However, high luminance contrast Landolt C (positive and negative contrast polarity) demonstrated better logMAR. As for the coloured background, the visual resolution measurements were significantly better for negative than that of the positive contrast polarity. Meanwhile, the visual resolution measurements significantly reduced without ambient illumination for both polarities. The significant reduction was further evidenced due to the presence of glare source at the nearest angle (5°), where the effect was more prominent under a high-intensity discharge lamp. In conclusion, the visual resolution measurements were found to differ due to the functions of colour, contrast, polarity and ambient illumination elements. Hence, the elements advocated the importance of optimizing a viewing condition based on the text-background contrast design and the surrounding lighting to enhance and improve the retrieval of information by the visual system.

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