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THE ILLUMINATING ENGINEERING INSTITUTE OF JAPAN

사단법인 한국조명·전기설비학회

THE KOREAN INSTITUTE OF ILLUMINATING AND ELECTRICAL INSTALLATION ENGINEERS

Poster Session (66 Posters)

August 22,17:30~18:30, August 23, 11:00~12:00

No.	Tittle	Author(s)	Place
PT-01	A Study of LED on Traditional Chinese Painting Exhibition in Museum Based on the Theory of Visual Perception	Guojian Hu	Block B Hall, Building 26
PT-02	Essences of 'LM-80, LM-84' and 'TM-21, TM-28' and Significance of Lumen Depreciation Test Assessment of LED Luminaire	Shiming Lu	
PT-03	Experimental Study on Chinese Preferences for Living Room Lighting in Relation to Gamut Area Index and Colour Rendering Index	Yaodong Chen	
PT-04	LED Eco Renovation- An Example of Store Lighting	Yasuyuki Oyagi	
PT-05	The Characteristics Evaluation of LED Package's Phosphor Coating Methods	Jung-Geun Lee	
PT-06	Influence of Illumination Level on the Visibility of the Stroboscopic Effect	Lili Wang	
PT-07	The Discussion of the Subjective Evaluation Methodology about Lamp Chroma's Influence on TV Broadcast Image Quality	Binghua Li	
PT-08	The Effect of Light Distribution in the Room on Visual Comfort	Fan Lu	
PT-09	Study on the Consistency of the Lighting Design and the Architectural Style	Peiqi Li	
PT-10	RYB Color OLED Lighting Improvable Visual Acuity and Eyesight Damage Caused by Presbyopia	Yuji Sano	
PT-11	Study Regarding Disability Glare Assessment Method Using Luminance Distribution Images	Yamada Tetsuji	
PT-12	Simulating Color Perception of Different Age Groups	Chan-Su Lee	
PT-13	Measurement and Analysis of the Photobiological Safety of Ultraviolet Cooker Hood	Min Cheng	
PT-14	Visual Environment Evaluation System of Subway Station Space	Fengqun Guo	
PT-15	Research about the Detection of LED Lamp Beads' Light and Color Parameters	Danping Yun	
PT-16	Measurement and Study on the Sky Luminance Distribution in Beijing	Tao Luo	
PT-17	Discussion on the Measurement Method of LED Spotlight in EMU Train Carriage	Wei Kong	
PT-18	Daylight Coefficient Computation Method for the Efficiency of Tubular Daylight Device	Shuxiao Wang	
PT-19	Verification of the Perez Sky Model in China	Aiying Wang	
PT-20	The Effect of LED Supplemental Lighting System for the Growth of Dendrobium Officinale Kimura et Migo	Xuesong Zhu	
PT-21	Research on the Energy-saving Management of Diurnal Illumination Matching the Daylighting in Office Space	Jingyu Yuan	
PT-22	LED Module Design of a High Power	Hongyi Zhong	
PT-23	Research Dynamic of Office Healthy Lighting Based on Non-visual Effects	Meiqi Fu	
PT-24	Design of LED Art Installation in the Department of Cardiology Based on Emotional Effect	Meng Zhang	
PT-25	LED Lighting, the Ideal Lighting for Tomorrow So Far	Tianyi Li	
PT-26	Current Status and Direction Investigation of Lamp Selection	Ye Ma	
PT-27	An Imaging Method for Measuring Room Appearance	Muhammad Safdar	

PT-01

A STUDY OF LED ON TRADITIONAL CHINESE PAINTING EXHIBITION IN MUSEUM BASED ON THE THEORY OF VISUAL PERCEPTION

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ABSTRACT

As a new type of light source, LED get in popularity rapidly at present, especially in museum. However, with the difference from traditional light source in several indicators, further discussion on LED's performance is required, as the research of LED lighting in museum is still not perfected.

This study take the visual requirements of traditional Chinese painting in museum exhibition space as the breakthrough point, discuss the LED lighting effect of visual perception on vertical plane exhibits of Chinese cultural relics in-depth.

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Keywords: Visual perception, Museum, LED, Lighting environment, Traditional Chinese painting

1. INTRODUCTION

This experiment aimed at exploring the influence of illumination and CCT of LED on traditional Chinese painting exhibits. This experiment sets up environment laboratory of museum LED lighting according to typical museum lighting space, selects a representative traditional Chinese painting as experimental samples, conducts a subjective evaluation experiment through 16 different light conditions, explores the museum LED lighting correspond with Chinese's preference. At last, through the analysis of experimental data, this study will provide theoretical guidance for museum LED lighting as well as the next phase of the experiment.

2. EXPERIMENTAL METHODS

2.1 Mock-up Museum

A 3.7x3.9x3 m mock-up museum,has been set up with a black shade curtain around its circumference to isolate exterior light and its low reflectivity surfaces reduced the reflective effects on the experimental museum items. The laboratory is divided into two by a black shade curtain, with an adaptation room at the entrance. The black shade curtain has a reflectance of 0.04 and the floor is covered with a neutral grey carpet with reflectance of 0.2. The size showcase is 1.2x0.8x2.6m. (KGM, Shanghai, Fig.1).

2.2 Experimental samples and luminaires

*The research project for conservation science and technology of State administration for cultural heritage, P. R. China. "The achievements demonstration for museum interior exhibit lighting environment control technology " (20120206)

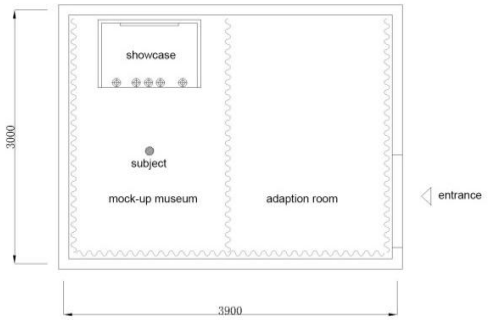

Fig.1. Plan of Mock-up Museum

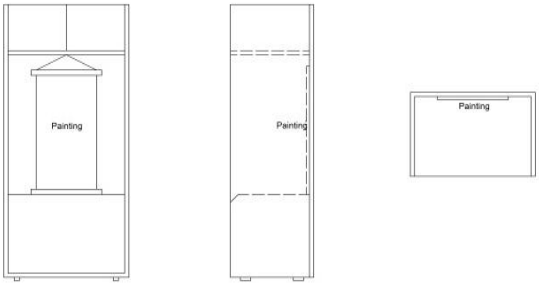

Fig.2. Showcase in three view drawing

Fig.3. Photos of Mock up Museum

A traditional Chinese painting of Qing Dynasty, 0.54 x0.36m,(Fig 3), has been selected as the experimental sample. To facilitate the study of the effects of LED light sources on illumination and CCT, the color rendering index of the experimental luminaires are higher than 85, an appropriate level for museums. The luminaires has been controlled by the DALI system to adjust the illumination intensity on the sample surfaces and a test has been conducted to ensure that over the range of illumination used there was no appreciable change the color performance of the luminaires. The selection of the luminaires installed needs to guarantee the intensity of illumination and complies with the parameters of the proposed experiments.

2.3 Experiment set design & Questionnaire

Experiments has been conducted by presenting 16 lighting conditions to the subjects and each of themhas been asked to make a visual appraisal of the Chinese traditional painting sample using a set of differential words to describe the various lighting conditions (Table. 1). Experimental scene order has been randomized. For the assessments, 14 expressions were chosen for color quality and the discrimination of detail in the painting.

NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CCT(K)	3000	3000	3000	3000	4000	4000	4000	4000	5000	5000	5000	5000	6500	6500	6500	6500
E(lx)	15	50	150	400	15	50	150	400	15	50	150	400	15	50	150	400

Table 1. Experiment set design

2.4 Experimental process

Each person has completed the experiment separately under guidance. At the start of each session, subject has been taken into the waiting area to read the instructions on the experimental procedures. If there were no questions, they would be given a set of assessment sheets. The waiting area illumination waslower than 5lx to adapt to low light levels before the assessments commence.

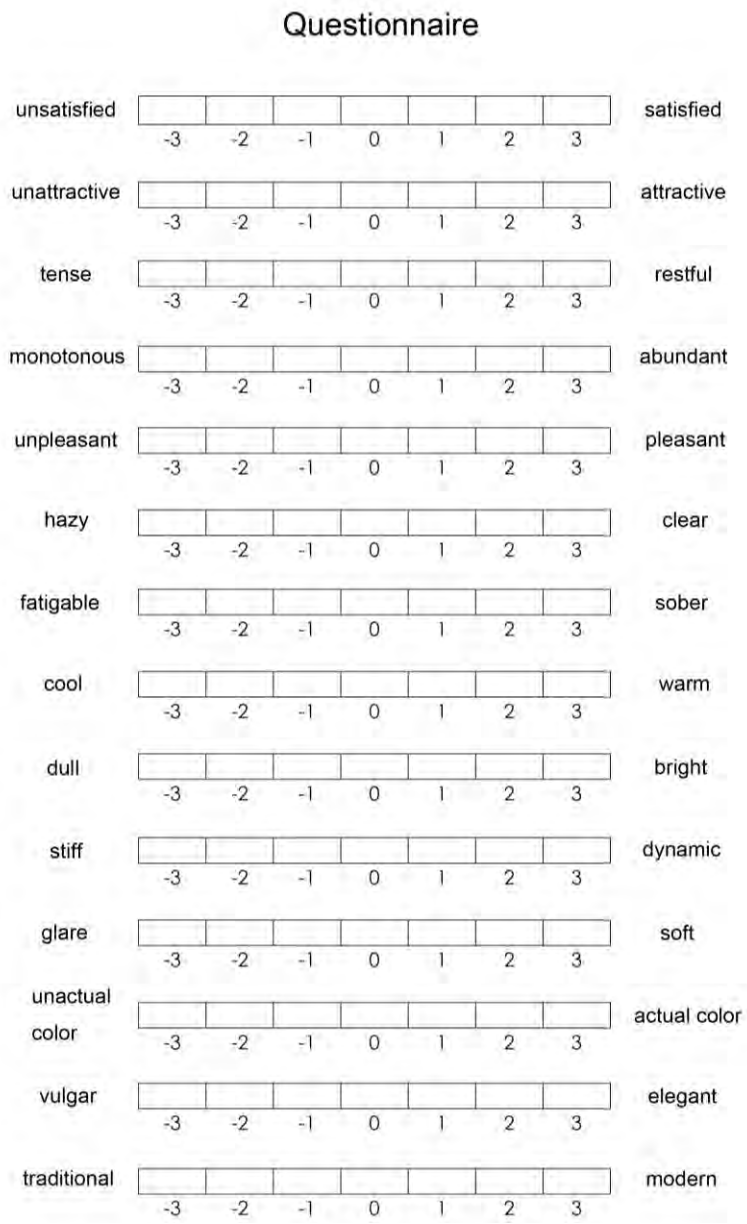

Fig.4. Questionnaire

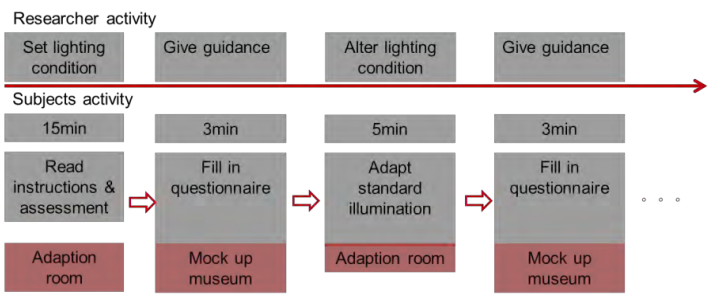

Fig.5. Progress of experiment

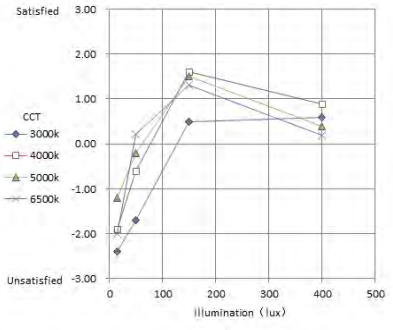

Fig.6. The relationship between satisfaction and intensity of illumination & color temperature

At the end of each session subjects returned to the adaption room where illumination remained at a fixed level. This would allow for time to alter the lighting conditions in the mock-up room for the next lighting condition.

Twelve people have participated, 6 male and 6 female, ranged from late teens to early fifties, all of whom have undergo the test for color blindness.

3. ANALYSIS OF DATA

3.1 Evaluation of satisfaction

Intensity of illumination and color temperature has interaction in satisfaction, illumination is the main influence factors, color temperature is the secondary factor.

[Intensity of illumination]

When illumination is less than 150 lx, intensity of illumination and satisfaction has significant positive correlation; But when the illumination is during 150 lx-400 lx, satisfaction Shows a trend of decline except 3000K.For traditional Chinese painting, 150lx gets the highest light environment satisfaction.

[Color temperature]

Overall, in same illumination conditions, the satisfaction of 4000K to 5000K for exhibits performance is highest, with 6500K as second, 3000K as lowest.

In the ancient paintings showroom, when painting article protection needs to be considered strictly and illumination has to be limited under 50lx, 5000k is recommended; when the illumination is controlled in 50lx-150lx, comprehensive satisfaction of different color temperature is approximate, which can be determined according to the specific requirements of the exhibits, but 3000K needs to be avoided; when illumination is higher than 150lx, it is recommended to use 4000k.

3.2 Evaluation of perception factor

Overall, the intensity of illumination of most of factors has remarkable effect on the value of perception, but classified discussion of each perception factor under various CCT is needed, cause the effect of CCT does not have consistency.

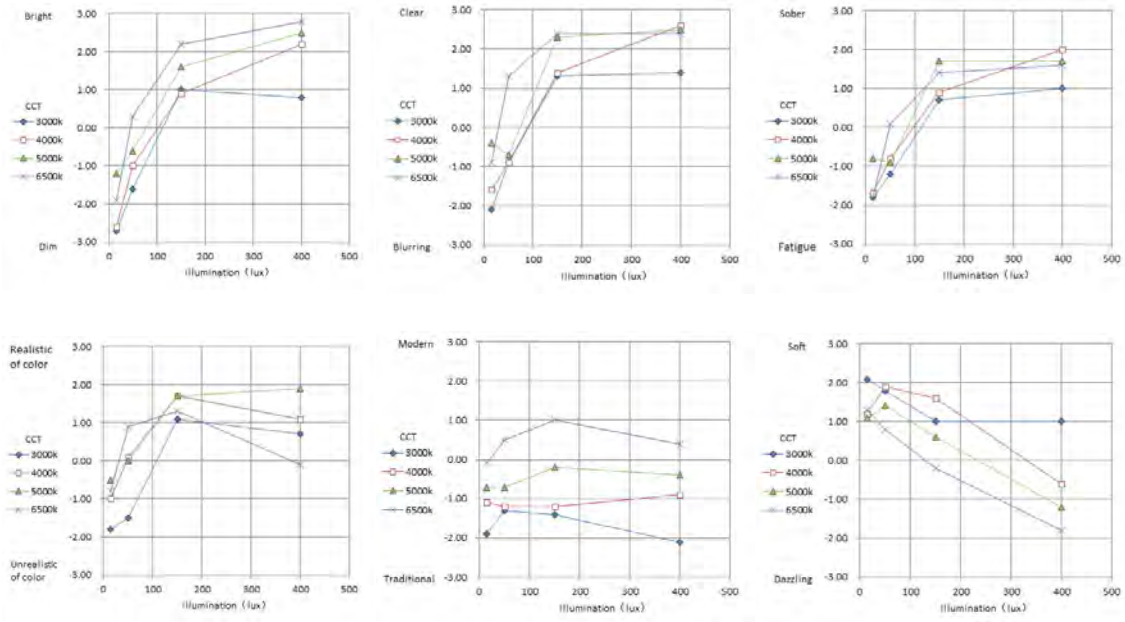

Fig.7. The relationship between factors and intensity of illumination & CCT

3.2.1Brightness, Clarity, Sobriety (non-fatigue)

All three factors show strong correlation between each other, with positive correlation to the illumination under 150lx, the growth slows over 150 lx. Overall, CCT has positive correlation with the three factors, namely high CCT as 5000K and 6500K has good performance; Low color temperature as 3000K is the most unfavorable, especially in the case of high intensity of illumination; the performance of 4000K has rapid growth over 150lx.

In museum visual perception, alleviating fatigue is an important factor to be considered, so 150lx is recommended with high CCT.

3.2.2Realistic of color

Overall, the intensity of illumination has more significant influence with the optimum illumination of 150lx; neutral color temperature as 4000K-5000K has better performance than high CCT or low CCT; low CCT as 3000K has the most negative performance of realistic of traditional Chinese painting; the performance of 6500K reduces rapidly over 150lx.

3.2.3The traditional sense

The intensity of illumination has little effect on the factor of traditional sense, while the influence of color temperature is more obvious. Overall the color temperature is negatively related to the sense of traditional rendering performance. So if traditional sense is wanted to be present, low color temperature should be considered; while if exhibits need to be more contemporary, high color temperature is recommended.

3.2.4 Softness

Overall, illumination shows significant negative correlation with soft feeling, namely the higher intensity of illumination, the greater degree of glare increases. On the whole, softness shows negative correlation with color temperature, namely the higher CCT, the lower softness, the more prone to the feeling of glare.

4. CONCLUSION

This experimental study set up a mock-up museum according to typical museum lighting space, selected representative traditional Chinese painting as experimental sample, conducted a subjective evaluation through 16 different scenes, explored the museum LED lighting effect of visual perception correspond with Chinese's preference. At last, through the analysis of experimental data, this study has provided theoretical guidance for museum LED lighting as well as the next phase of the study.

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