



TITLE:

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CITATION:

Nakatsu, Ryohei ...[et al]. Evaluation of Art Lighting Combining LED Lighting and Glass Art by Psychological Experiment. Proceedings of ADADA2020 2020: 2A_3.

ISSUE DATE:

2020-12

URL:

<http://hdl.handle.net/2433/265526>

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Evaluation of Art Lighting Combining LED Lighting and Glass Art by Psychological Experiment

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Abstract

We investigated how people feel and evaluate artistic lighting in both working and relaxing environments. We have carried out a psychological experiment comparing two types of art lighting created by us and an ordinary LED lighting. Twenty four subjects filled in questionnaires to evaluate each lighting and the result was statistically analyzed. It was revealed that both of the art lightings are highly evaluated in various relaxing environments. At the same time, it was found that the art lightings have the capability of making people creative in the working environment.

Keywords: Glass art, art lighting, psychological experiment

1 Introduction

Lighting has played a major role in our lives by relaxing people at home, making work efficiently in the office, etc. What kind of lighting is adequate in various situations is an important theme, and many studies have been conducted. Especially in recent years, LED lighting is replacing conventional lighting in many places due to its characteristics such as durability and low power consumption. Creating a space that is rich in design and art is the basis of the usage of LED lighting. The motivation of this research is to create new lighting by combining LED lighting and art.

Glass has a good affinity with lighting because of its transparency, the ability to create various shapes, and the ability to add various colors. It is expected that the combination of LED lighting and glass art would create new lighting and would have the effect of calming and relaxing people and even improving work efficiency.

2 Related research and activities

In living spaces and office spaces, lighting has a great influence on people who live there or work there, such as relaxing people and improving work efficiency. Therefore, psychological experiments have been conducted using many subjects to see how people feel by changing lighting conditions in various situations [1][2].

On the other hand, there are several evaluations of artworks by psychological experiments [3][4], but there seems to be no example of trying to evaluate artistic lighting.

3 Fluid art and glass art as its extension

3.1 Fluid art

How fluid behaves under various conditions is an important research theme research in physics, and has been called "fluid dynamics." It is well known that fluids produce extremely beautiful shapes under various conditions. As beauty is a basic element of art, it is natural to use fluid dynamics as a basic methodology for art creation. Naoko Tosa, one of the authors, has been creating video art called "fluid art."

3.2 Fluid art "Sound of Ikebana"

Naoko Tosa has found that fluid such as paint can create an Ikebana-like shape by giving it sound vibration and shooting the phenomenon with a high-speed camera. She confirmed that various fluid shapes can be generated by changing the sound shape, sound frequency, fluid type, fluid viscosity, etc. The video image obtained in this way was edited to match the colors of the Japanese season, and a video art called "Sound of Ikebana" was created [5]. Figure 1 is a scene from the video art.

What is interesting is when she exhibited the video art in various parts of the world, many overseas art-related people said, "Tosa's art is an abstract representation of beauty hidden in physical phenomena and that is the core of Japanese beauty." This made us think about what art is and what beauty is, especially what Japanese beauty is and we are trying to approach such a problem.



Fig. 1 Scene of "Sound of Ikebana."

3.3 Sound of Ikebana as glass art

Many people feel the Japanese beauty in the Sound of Ikebana, and many of them expressed the opinion that it is interesting if the Sound of Ikebana can be realized as a three-dimensional object rather than just an image. In response to this, we, led by Naoko Tosa, have attempted to create shapes similar to the Sound of Ikebana with glass. As the actual flower arrangement combines multiple types of flowers and plants to make one work, we make each part with glass, and by combining them we try to create a three-dimensional object similar to the Sound of Ikebana.

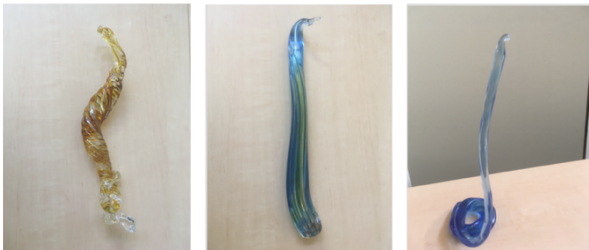


Fig. 2 Examples of produced glass art.

There are two types of glass art production methods, hot work and cold work, but we use hot work to create the organic shape of the Sound of Ikebana. Similar to the blown glass production method, the glass seeds heated in the melting furnace are wound on a blowing rod, but instead of blowing breath into it, various processes are carried out such as twisting or hanging a soft glass. We have also tried coloring the glass art by adding various pigments in the creation process. Figure 2 shows examples of the glass art created. By combining such glass art with LED lighting, it is possible to realize artistic lighting (see Fig. 6).

4. Psychological experiment

4.1 Experimental environment

As an environment for conducting psychological experiments, we assumed two environments: a working environment (office, etc.) and a relaxing environment (living room, hotel lobby, etc.).

(1) Working environment

A desk and a chair were installed in the laboratory to simulate an

office environment (Fig. 3). Figure 4 shows the LED stand lighting used in the experiment. Its brightness was 1000 lumens and the illuminance on the desk was about 900 lux, which was sufficient for office work. The subjects were asked to spend a few minutes in this environment while imagining doing office work and then were asked to fill in the questionnaire about their feelings.

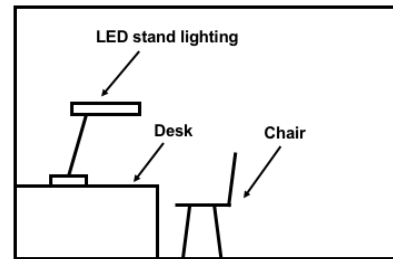


Fig. 3 Working environment.



Fig. 4 LED stand lighting used in the experiment.

(2) Relaxing environment

A desk was set up in the laboratory and art lighting was used (Fig. 5). The subjects were instructed to watch the art lighting, and after sitting down at the desk for a few minutes, they were asked to respond to a questionnaire about their feelings. The illuminance at the subject's position was about 500 lux, which was a little dark environment for office work.

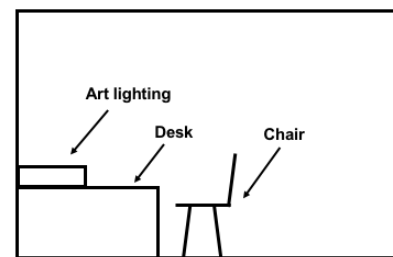


Fig. 5 Relaxing environment.

The two types of art lightings were used in the comparative experiment are shown in Figs. 6. The art lighting 1 is a three-dimensional arrangement of the glass art imitating an Ikebana. By illuminating it with LED lighting from below, people can enjoy the effect of the light reflected from the glass art and the light transmitted through it. The art lighting 2 is constructed by arranging individual glass art on a circular shape board and illuminating the glass lighting from the rear with a horizontally long LED lighting.

And by slowly rotating the circular board with glass arts, we aimed to create a dynamic effect.

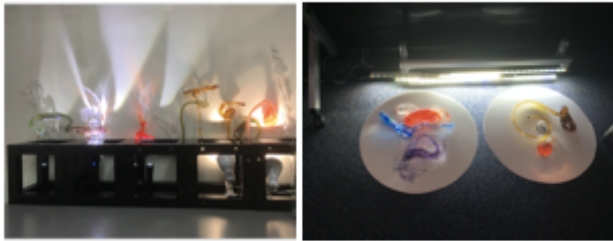


Fig. 6 Art lighting (left: art lighting 1, right: art lighting 2)

4.2 Subject

19 students from Kyoto University (11 men, 8 women, age 20's) and 5 staff from Kyoto University (2 men, 3 women, age 20-40), resulting in 24 people (13 men, 11 women) were used as subjects.

4.3 Psychological experiment procedure

Each subject was asked to spend 2 minutes in each of the working environment with the LED lighting and two relaxing environments with the art lightings 1 and 2, and after each of the experience was asked to fill in a questionnaire. The order of each environment was fixed as the above. However, we tried to avoid the influence of the order effect by having the questionnaire be revised if necessary after the end. However, most subjects did not feel the need for modification.

Table 1 Contents of the questionnaire

1. How did you feel about the lighting? Comfortable – Uncomfortable Friendly – Unfriendly Beautiful – Not beautiful Calm – Restless Interesting – Boring Warm – Cold Dynamic – Static Luxury – Sober Unique – Mediocre	I can be creative – I can't be creative. I feel energetic – I don't feel energetic I can face difficulty – I can't face difficulty I feel refreshed – I don't feel refreshed
2. What effect does the lighting have? I can relax – I can't relax	
	3. What kind of scene is the lighting suitable for? Appropriate for sleeping – Inappropriate for sleeping Appropriate for eating – Inappropriate for eating Appropriate for relaxing – Inappropriate for relaxing Appropriate for working – Inappropriate for working Appropriate for chatting – Inappropriate for chatting

4.4 Questionnaire

A questionnaire was used to evaluate the psychological impact of those environments on people, and the subjects were asked to fill in the questionnaire on a 7-point scale. Regarding the question, we prepared three types of questions: "How did you feel about the lighting?" "What effect does the lighting have?" "What kind of scene is the lighting suitable for?" The specific contents of the questionnaire as shown in Table 1 were decided regarding the other similar studies [1][2][3][4].

5. Analysis and consideration

5.1 Results about "How did you feel the lighting"

Figure 7 shows the average value, standard deviation, and the result of t-analysis (**: 1% level, *: 5% level) for two representative questions; "dynamic" and "friendly."

For almost all items, we obtained the result that the art lightings 1 and 2 are favored over the LED lighting with a significance level of 1%. However, regarding "friendly", there was no significant difference between the art lightings 1, 2, and the LED lighting. Since the LED lighting is familiar to us in our everyday life, it is considered that the same evaluation was obtained as compared to the art lighting.

On the other hand, regarding the difference between the art lightings 1 and 2, there was no significant difference in most items. Since art lighting 2 incorporates movement, we expected that there would be a significant difference in terms of items such as "dynamic", but so far no significant difference was obtained. Probably as the rotation speed of the board was very slow, the art lighting 2 did not give the subjects a dynamic feeling.

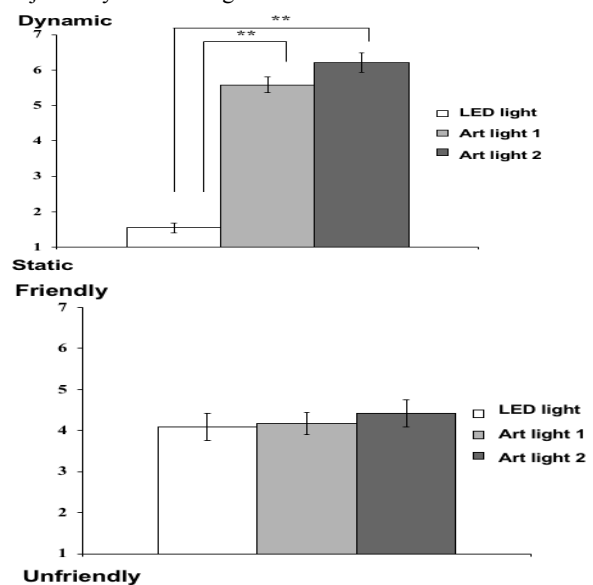


Fig. 7 Two representative results for the question "How did you feel about the lighting?"

5.2 Results about "What kind of effect does the light has?"

Figure 8 shows the average value, standard deviation, and the result of t-analysis (**: 1% level, *: 5% level) for two representative questions; "I feel refreshed" and "I can be creative."

Regarding the items that have the effect of healing such as "relaxing" and "refreshing", the art lightings 1 and 2 are superior to the LED lighting at a significance level of 1%. On the other hand, no significant difference was found in the items related to the will of the person, such as "I feel energetic" and "I can face difficulties". It is interesting to note that the results of the art lightings 1 and 2 are superior to the LED lighting at the significance level of 1% or 5%

regarding the item "I can be creative". This suggests that art lighting can be used effectively in work situations if used properly.

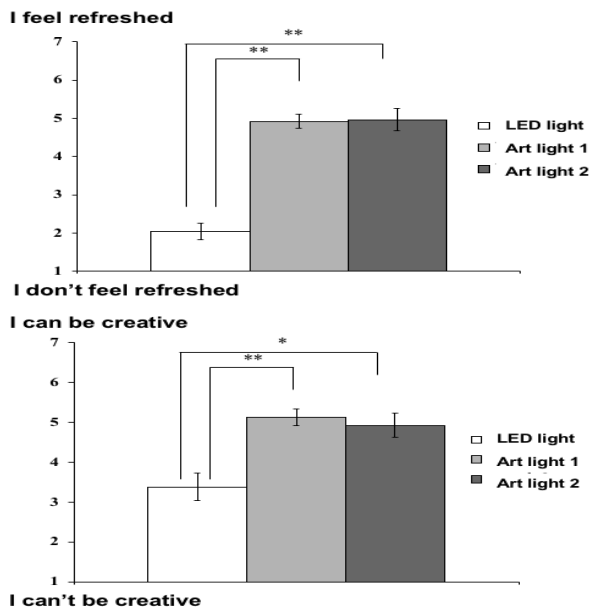


Fig. 8 Two representative results for the question "What effect does the lighting have?"

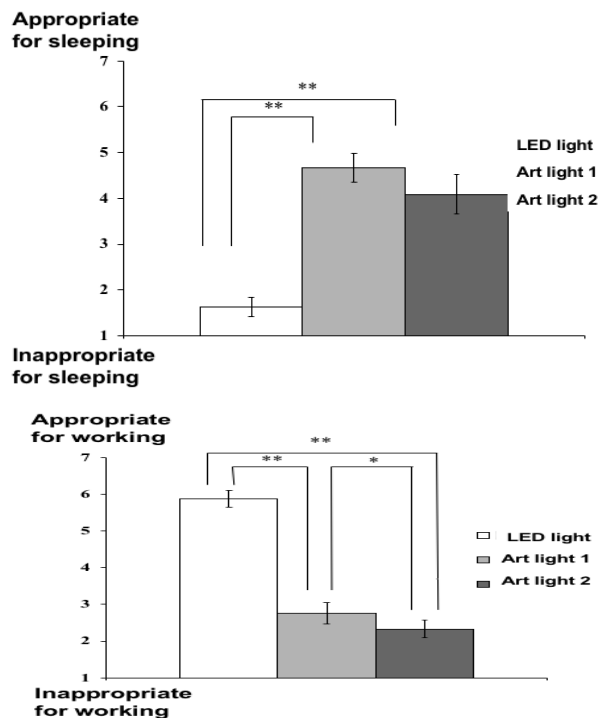


Fig. 9 Two representative results for the question "What kind of scene is the lighting suitable for?"

5.3 Consideration on "what kind of scene is the lighting suitable for"

Figure 9 shows the average value, standard deviation, and the result of t-analysis (**: 1% level, *: 5% level) for two representative questions; "appropriate for sleeping" and "appropriate for working." Regarding the items of "sleeping" and "relaxing", we obtained the

result that the art lightings 1 and 2 are favored over the LED lighting at a significant level of 1%. This is also similar to the results obtained in 5.1 and 5.2, and therefore be an expected result. On the other hand, concerning the item of "working", the LED lighting is evaluated higher than the art lightings 1 and 2 with a significant level of 1%. This again shows that simple lighting is preferred in the office environment. However, as mentioned in 5.2, the art lightings 1 and 2 have higher results compared to the LED lighting in the item "I can be creative." This shows the possibility of realizing a working environment that enhances productivity and creativity by introducing art lighting in an office environment. How to realize this will be a future issue.

6. Conclusion

To find out where and for what purpose the art lighting, which is a combination of glass art and LED lighting, we have carried out a psychological experiment. Two types of art lightings created by us and simple LED lighting were compared in two types of environments, working environment and relaxing environment, by letting 24 subjects fill in a questionnaire. By analyzing the results, we have found that art lighting is superior to LED lighting in many situations. In the future, we would like to confirm the universality of these results by expanding the number and age of subjects and increasing the types of glass art used.

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