Covenant Journal in Research & Built Environment (CJRBE) Vol. 8 No. 2, December, 2020
***ISSN*: p. 2384-5724 e. 2384-5716 DOI: xxxxxxxxxxxxxxx**

An Open Access Journal Available Online

Effects of Sustainable Lighting Strategies on Users' Patronage of Visual Art Centres in Lagos, Nigeria

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Received: 15.10.2020 Accepted: 23.11.2020
Date of Publication: December, 2020

Abstract: This paper set out to identify the relationship between the sustainable design of lighting within a visual art centre and its effect on the patronage of users in the study area. The study employed a mixed methods approach using case study analysis and questionnaires to collect data. In the course of research two art galleries namely; Nike Art gallery and Hour glass art gallery were compared with the prior deemed to be more sustainable with its integration of lighting; and the results of the amount of patronage compared to determine if the effect of sustainable lighting strategies on user patronage was indeed significant if existent at all. The study at the onset, hypothesised that an art centre integrating more sustainable lighting strategies can be expected to demand more patronage from users as the users are intuitively attracted to the benefits of such a design. Upon completion of the paper it was concluded that the levels of patronage observed did not vary greatly between either gallery. The study recommends further studies on a larger scale to arrive at more generalisable conclusions

Keywords: Lighting, Lighting Strategies, Sustainability, Users' Patronage, Visual Art Centre

1.0 Introduction

According to Neirotti, De Marco, Cagliano, Mangano, and Scorrano, (2014) sustainability involves an integrated approach. The factors of environment, economy as well as social aspects are all to be interconnected. Sub-domains in sustainable developments also involve integration of culture, technology, and political factors. Sustainable development is simply a development that meets the needs of the present generation without being detrimental to future generations of human beings meeting their own needs. Drawing inferences from Markusen, Johnson, Connelly, Martinez, Singh, and Treuer, (2006) a visual art centre is a community centre that focuses on the creation, exploration and exhibition of art. It may feature galleries, classrooms, studio spaces and offers a space where artists can come together to learn about and create art in various disciplines (Çevik, & Kazanasmaz, 2019). In such a building or in similar designs such as museums and art galleries, lighting performs different functions. With light, one can create scenes and modern technology makes it possible to mimic natural daylight (Hassanizadeh, Noorzai, & Mohseni, 2020). Picking the lighting strategy is a complex decision that will involve factors such as user comfort and energy consumption. The choice of light fixture also affects the lifespan of the artworks being displayed or stored (Çevik, Kazanasmaz, & Duran, 2020). This paper's goal is to identify the relationship between the sustainable design of lighting within a visual art centre and its effect on the patronage of users in the study area. The outlined objectives were to - identify the frequency of visits by selected users in the respective galleries; determine the Emotions experienced; and determine the levels of satisfaction of these same users. The study investigates how the use of sustainable lighting strategies in visual art centres will affect the level of patronage users in Lagos, Nigeria. The research hypothesised that an art centre integrating more sustainable lighting strategies can be expected to demand more patronage from users as the users are intuitively attracted to the benefits of such a design. The scope of study was narrowed down to two art galleries in Victoria Island, Lagos, Nigeria a region with a high population of visual art centres-Art galleries. The study is expected to help stakeholders define the necessity of sustainable lighting strategies in future visual art centre designs and also improve the current art centre designs.

2.0 Literature Review

According to Robertson, (2017), when lighting a visual art space, the multiple considerations include, broadly; the application of artificial light and the use or exclusion of day light or natural light. Regarding sustainability in lighting galleries, museums and visual art centres, the issue is usually broadly concerned with how artificial or natural light is handled and controlled. In lighting sustainability (www.sustainability.williams.edu/gr

een-building-basics/lighting)

sustainability, when it comes to lighting also covers the level of user comfort. The focus however was on utilising daylight, to save energy on artificial lighting; Good daylighting is defined as being diffuse, soft and uses indirect reflected light as opposed to artificial lighting (Lechner, 2014). Sustainability can be achieved with artificial fixtures in numerous ways but mainly by specifying efficient fixtures and control systems (Baker and Steemers, 2014).

Man-made or artificial lights have developed over the past few years with more and more sustainable technology. According to Emrah and Ashleigh (2015) changes in policies as well as the emergence of a knowledgeable public has advanced the move to LED (Light emitting Diode) light sources that facilitate energy savings in most galleries and museums. In their study using case study analysis, it was inferred that wide ranges of lighting upgrade initiatives exist that can help achieve sustainability with optimal solutions for different sizes of visual art centre. On daylight arguments, Tregenza, and Wilson (2013) argue that among other theories, the historical prevalence is one reason to keep using daylight to observe and store art.

Furthermore, daylight keeps users entertained with external views, keeping the users connected to the outside world while offering a sense of time. Daylight releases no CO^2 and as such, it is more sustainable than artificial light (Alagbe, Aderonmu, and Dare-Abel, 2015). Crucially daylight saves money with less energy expenditure and allows art work to be rendered in the full colour spectrum of light. The common arguments against daylighting in galleries are UV radiation and its control difficulty. These are solved however by proper planning and the use of UV filters (Cassar, 2013).

Another argument for use of daylight to achieve sustainable lighting is in Arup Lighting Design's lighting catalogue (2018). The position is that daylight is carbon free, cost free and plays an important part in well-lit visual art centres when properly controlled. Uncontrolled daylight however, can cause overheating in spaces and damage artworks. They further state that, particularly in museums that shut off daylight the architecture of the spaces can become inaccessible cutting off the arm of sustainability that has to do with user satisfaction. In Emrah, Richard, Fiona, and Julian, (2013) it was mentioned that visual art centres are faced with the growing concerns of reduction in energy consumption, greenhouse emissions and economic sustainability. Ideally, the visual art centres should follow in the footsteps of other industries in the pursuit for sustainability. A quote from Sylvania (2015) puts it simply: "*The lighting challenge faced in today's museums and galleries is to achieve a balance between the quality of the lit environment – no matter what is being displayed – and the level of*

energy used during the life of the installation."

For Guimaraes (2019) modern ideas in the field of passive design are making use of natural resources that are more renewable – that are more sustainable. Daylighting in architecture is more advanced in current climes with technological advancements also allowing more progressive designs. One can now use the innovations to regulate internal light levels more efficiently. Drawing inference from Aderonmu, Adesipo and Eroebor (2019) lighting projects that are well designed allow for savings on electric power from both artificial lights and cooling loads. Optimal use of daylighting will come in the form of either top lighting or side lighting and contributes in the end to energy efficient building designs when properly controlled while also catering for more satisfactory user perception (Shi and Chew, 2012). Guyer, (2018) posits that if the building employs passive means of lighting -daylighting effectively, it will achieve a more sustainable outcome. The other option is to employ the use of lighting controls. The study on lighting sustainability establishes that to maximise daylight, and therefore sustainability, the building's shape, windows sizes and positions, high ceilings for deep light penetration, use of light shelves, shading devices as well as high reflectance materials along with clerestory windows can all help.

3.0 Methodology

Combination of qualitative and quantitative techniques was employed to acquire information in this research. The study area Victoria Island Lagos, Nigeria was earmarked because of the concentration of visual art centres. Of all the visual art centres in the study area, that incorporated passive daylighting strategies in tandem with a few other sustainable measures -Nike Art Gallery was selected and another that relied solely on artificial measures with no light control measures targeting sustainability is Hour Glass Art Gallery. The case studies were observed and 15 random users were asked questions relating to the level of patronage and satisfaction in the respective galleries. The results are presented using pictures, tables and charts. The questionnaires were used to obtain quantitative data while the case study observations and interview guide were engaged to obtain qualitative data on the Art galleries.

4.0 Results and Discussion

Employing a comparative approach between two art galleries in the study area, the study observed on one hand, Nike Art gallery a visual art centre employed a mixed lighting approach (i.e. using both daylighting and artificial lighting) and on the other, Hour glass art Gallery which employed artificial lighting alone in its gallery. The surveys distributed were targeted at random visitors or users from varied backgrounds and a representative sample of 15

respondents were selected in each gallery. The focus of the survey was to investigate how users responded to lighting strategies employed in terms of interaction, satisfaction and patronage and among other things, using objectives - identify the frequency of visits by selected users in the respective galleries; determine the emotions experienced; and to determine the levels of satisfaction of these same users.

4.1 Result On Identify the Frequency of Visits by Selected Users in the Respective Galleries

Figure 1a below show the survey carried out in the Nike Art gallery, 53% of respondents were male and the other 47%, female. Majority of the participants about 67%,were between the ages of 20-30 years old. Nearly half – 47% of all respondents at the time of distribution happened to be architecture students, artists, gallery owners, curators, art students and others forming the remainder of respondents with 25%, 7%, 7%, 7% and 7% respectively.

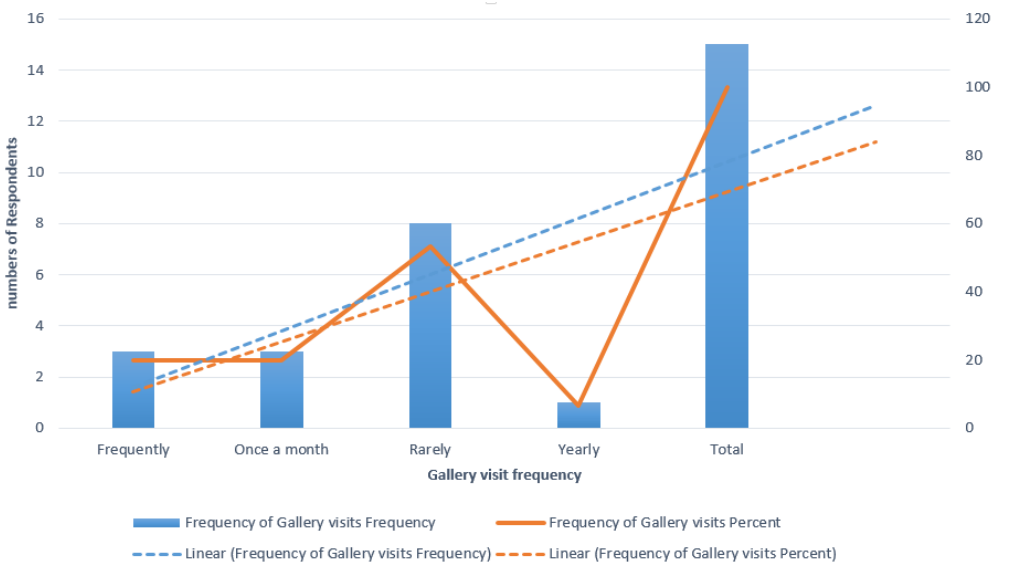

Figure 1a: Clustered column with line on secondary axison frequency of gallery visitations

53% of respondents were reported to visit the gallery rarely and only one of the respondents using the art gallery once a year. 40% of respondents stated that they use the Nike art galleries either frequently-multiple times a month or once a month as shown in figure 1b and 1c.

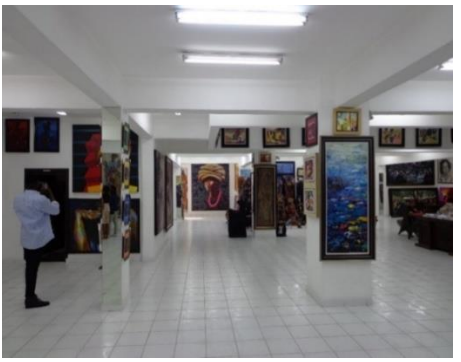

Figure 1a: Nike Art Gallery exhibition hall façade

Figure 1b: Nike Art Gallery exterior

In the Hour glass Art gallery, 60% of the respondents were male and the other 40%, female. Most of the participants - 40% were between the ages of 20-30 years old, 13% were 60+ years old, 20% between the ages of 41-50 and 14% and 13% were between 10-20 and 31-40 respectively as represented in figure 2a. It was observed that 60% of all respondents at the time of distribution happened to be Artists, with gallery owners, curators, art students, architecture students and others forming the remainder of respondents with 13%, 7%, 7%, 7% and 7% respectively.

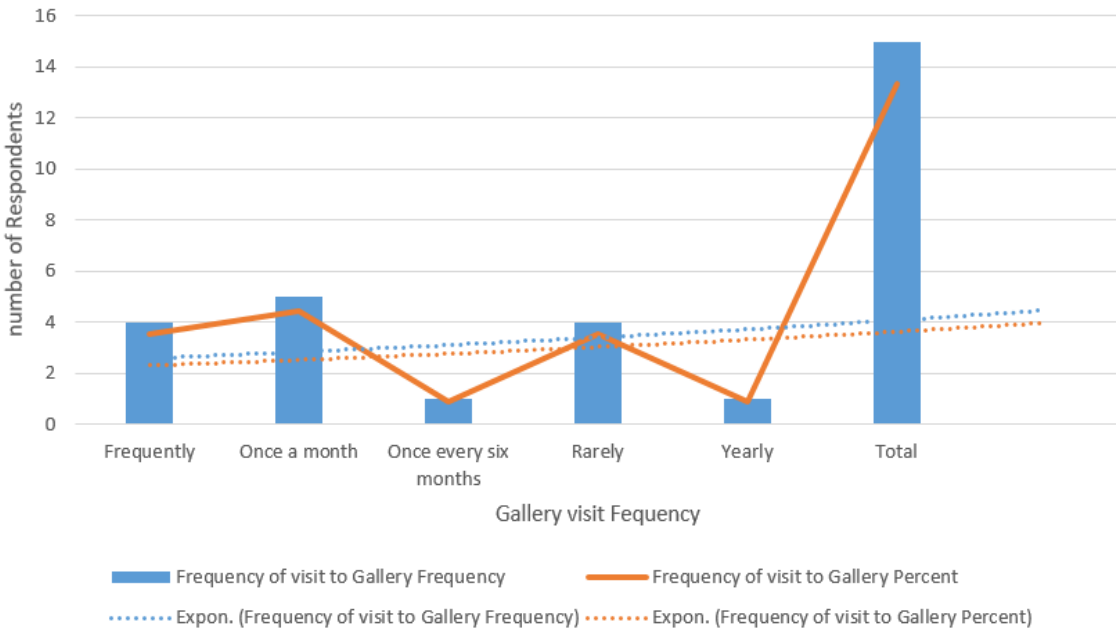

Figure 2a: Clustered column with line on secondary axis showing frequency of gallery visitations

Mainstream of respondents amounting to 60% in the hour glass art gallery was reported to at least visit or use the art gallery once a month with 26.7% of respondents declaring themselves to be frequent users. 1 respondent reported using it once in every six months while 33% respondents rarely use the Hour Glass art gallery, or otherwise use it once a year. See figure 2b & 2c respectively.


Figure 2a & 2b: Interior of Hour glass art gallery

4.2 Result on Determine The Emotions Experienced(Effects of Lighting on User Experience)

The respondents were asked to answer if lighting had any effect on certain selected factors. The respondents were asked if lighting within the space elicited any emotional response and in the particular gallery 86.7% of respondents said it did. The respondents were also asked for specific emotions that they experienced and their responses are highlighted in figure 3a below. 86.7% of respondents suggested that lighting within the gallery did indeed cause them to interact with the art more than the lighting increased art learning within the gallery and also stated that the lighting aroused more excitement and increased usage of the gallery. The respondents were also asked questions pertaining to increase in interest in art and satisfaction all linked to the lighting system in place at Nike Art Gallery. 11 of the respondents (73.3%) agreed that the lighting increased their interest in art work.

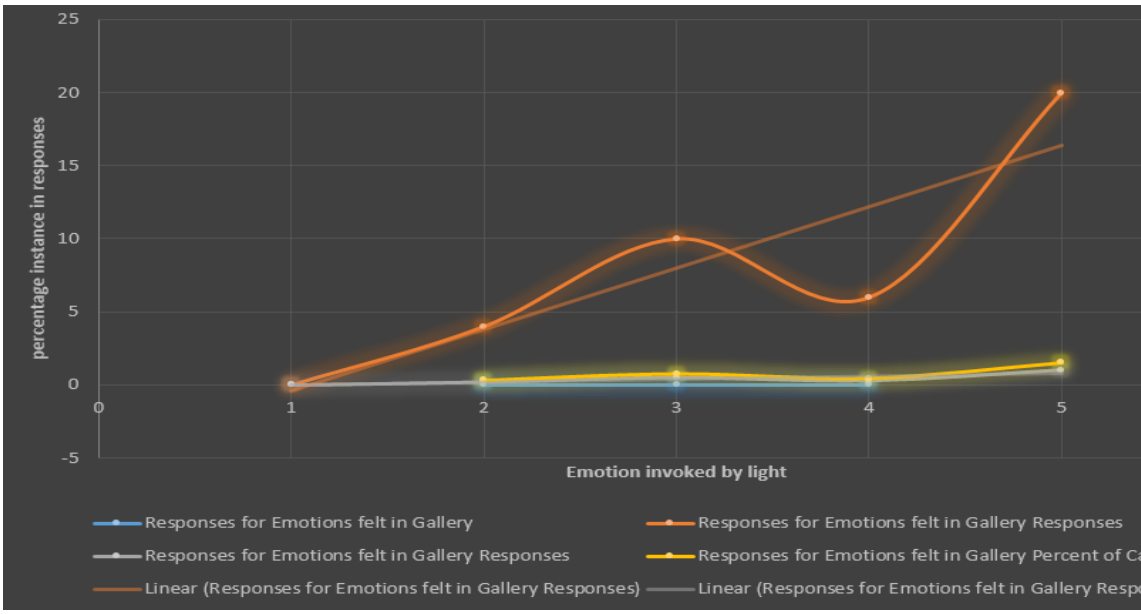

Figure 3a: Scattered bar with smooth lines and markers showing Emotions of respondents to lighting

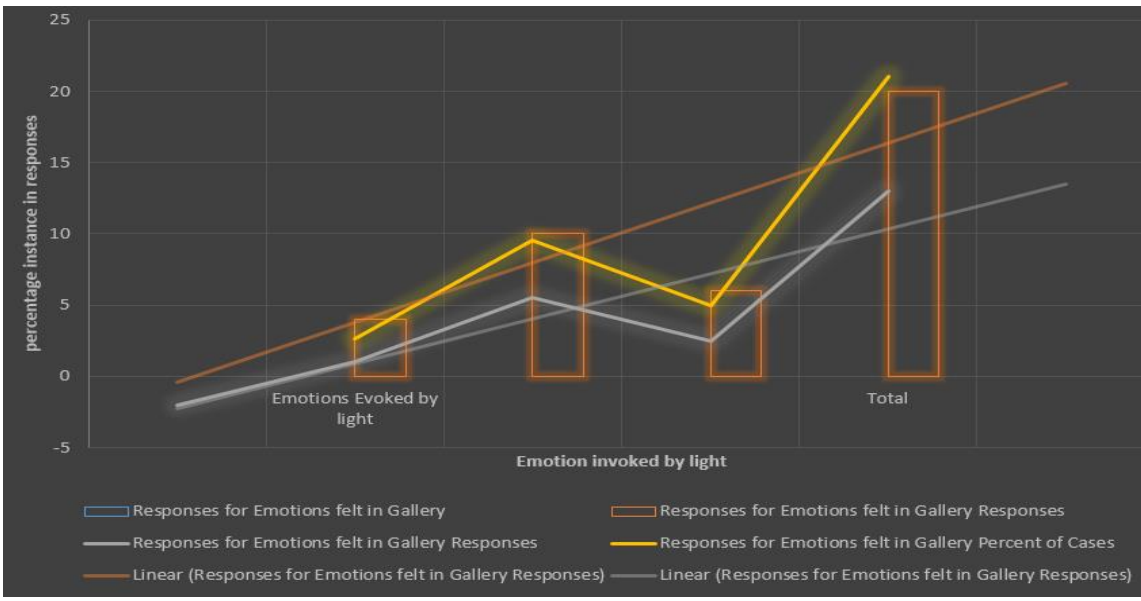

Figure 3b:Clustered column with line presenting Emotion Felt in the Gallery

Figure 3b revealed that Among the 15 Respondents, the survey gave an opportunity for multiple responses and 77% of the time, 66.7% respondents said the lighting caused happiness; sadness was selected 31% of the time amounting to 4 respondents and in 46% of responses accounting for 6 respondents selected an option suggesting they were unsure of the emotion evoked.

The respondents were asked if lighting within the space elicited any emotional response and in the particular gallery 93.3% of respondents said it did. Respondents were also asked for emotions that they experienced and their responses are highlighted in figure 4a below. 93% of respondents suggested that lighting within the gallery did indeed cause them to interact with the art more,86.7% reported that the lighting increased art learning within the gallery and also stated that the lighting aroused more excitement and 93.3% affirmed that it increased usage of the gallery. The respondents were also asked questions pertaining to increase in interest in art and satisfaction all linked to the lighting system in place at Hour Glass Art Gallery. 14 of the respondents (93.3%) agreed that the lighting increased their interest in art work.

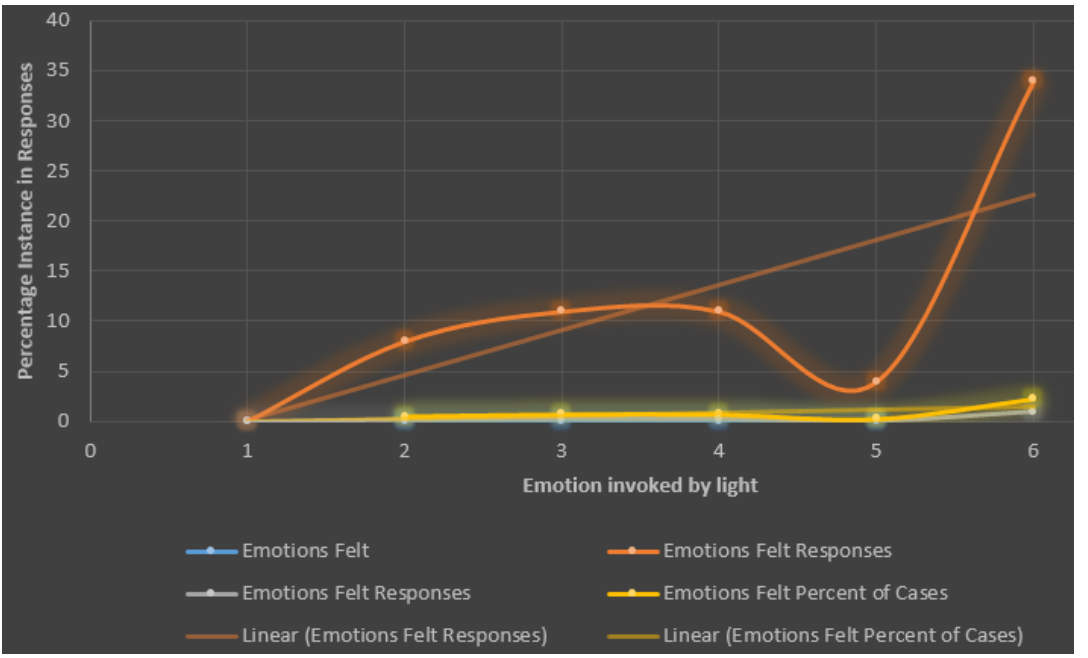

Figure 4a: Scattered bar with smooth lines and markers showing showing Emotions of respondents

Figure 4b indicted that among the 15 Respondents, the survey gave an opportunity for multiple responses and 32% or 73% of the time, 73% of respondents said the lighting caused happiness; sadness was selected 24% or 53% of the time and in 32% or 73% of responses representing 11 respondents selected an option suggesting they were unsure of the emotion evoked. In this particular gallery 12% of responses also featured responses not among the multiple presented.

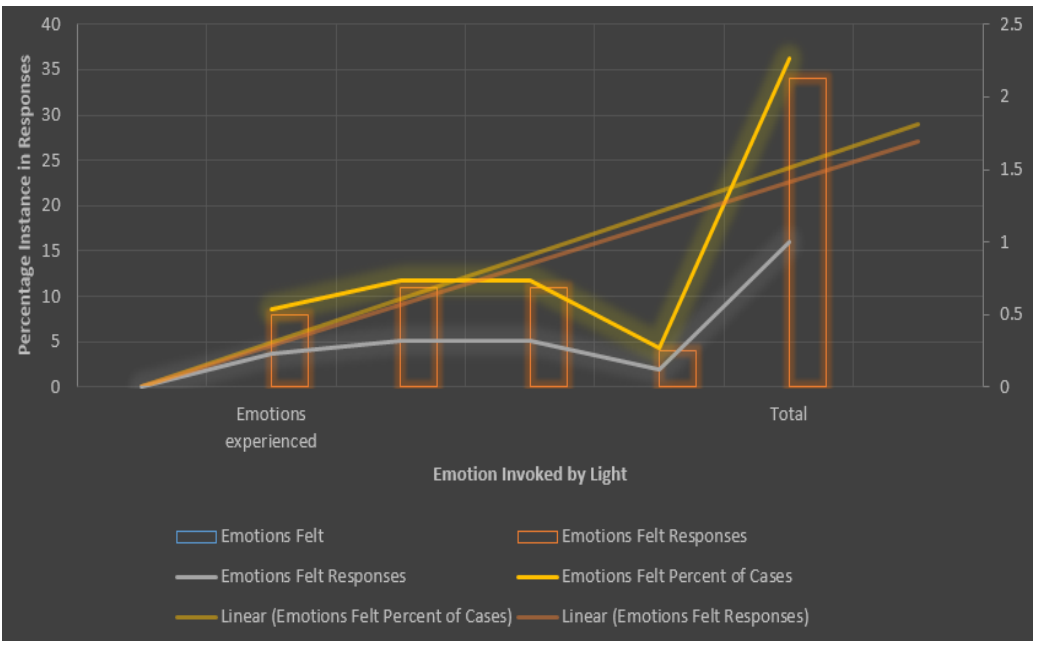

Figure 4b: Clustered column with line presenting Emotion Felt in the Gallery

4.3 Result on Determining the Levels of Satisfaction of These Same Users

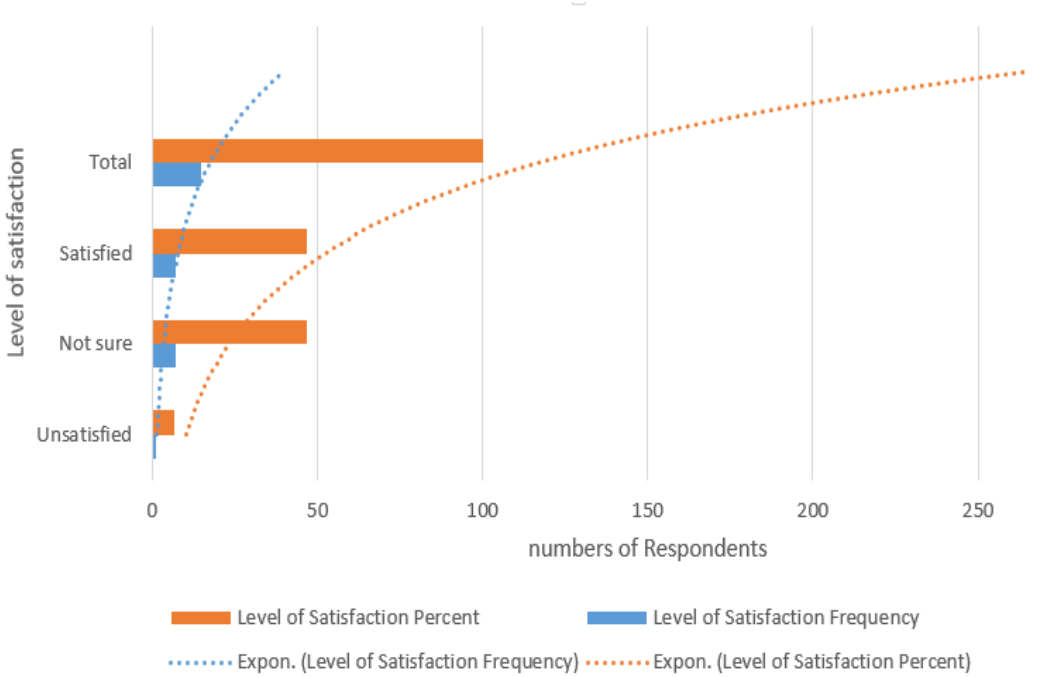

Figure 5a: Clustered bar showing Satisfaction of respondents

As the figure 5a shows, 8 respondents of the 15 reported being either unsure of satisfaction or that they were unsatisfied. 7 others reported being satisfied, in this particular gallery there weren't any responses in the categories of very satisfied or unsatisfied. This reveal that level of satisfaction is high and in-turn prove that there might be more patronage with sustainable lighting strategy.

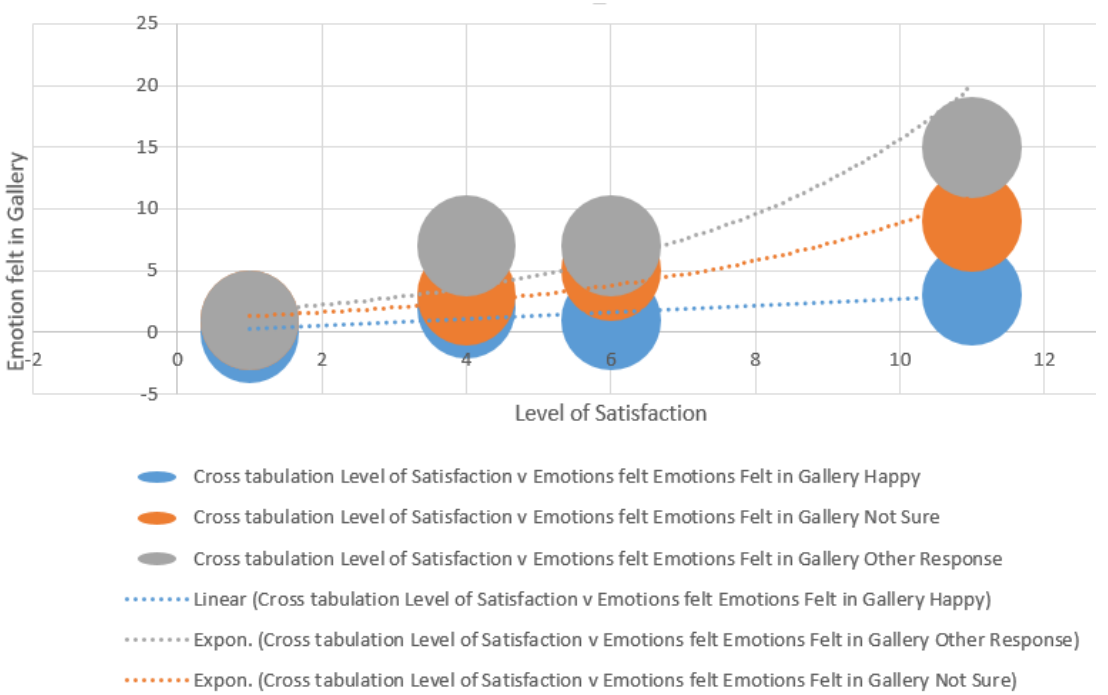

Figure 5b: Scattered bar with bubble present Cross tabulation Level of Satisfaction v Emotions felt

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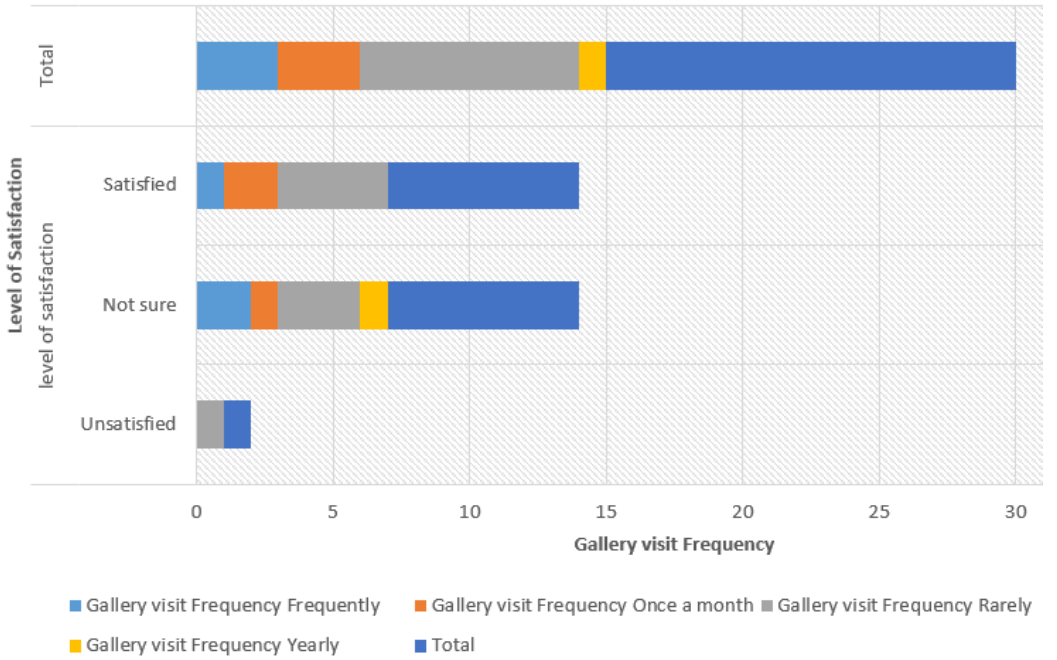

Figure 5c: Stacked bar present Cross tabulation Gallery visit frequency v Level of Satisfaction

The scattered bar with bubble in figure 5b show that there is relationship between level of satisfaction and emotion felt in the Nike Art gallery. 10 satisfied respondents connected the emotion to sadness. 3 satisfied respondents tied their satisfaction to happiness while 8 satisfied respondents were not sure of their emotion. In figure 5c, the stacked bar present a relationship between gallery visit frequency and level of satisfaction in Nike Art Gallery. 14 respondents amounting to 93% confirm that the level of satisfaction determine the frequency of their visit to the gallery. This also further determine the degree of patronage.

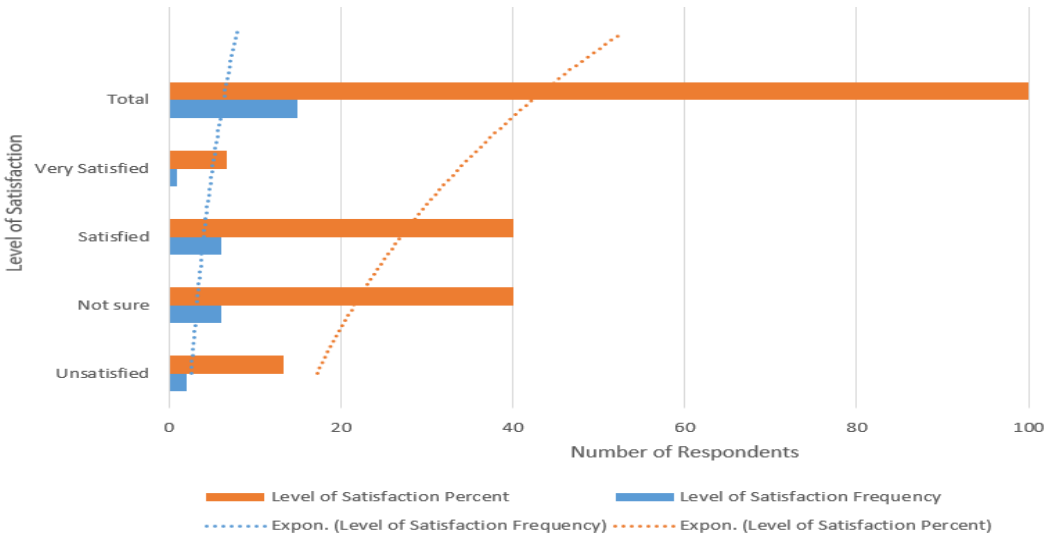

Figure 6a: Clustered Column showing Level of satisfaction of respondents

The distribution for satisfaction was similar in the hour glass art gallery as 7 respondents reported being either very satisfied or satisfied with 8 being either unsure or unsatisfied. The distributions can be said to point to an average level of satisfaction or a satisfactory level.

Figure 6b: Scatter with bubble present Cross tabulation Level of Satisfaction v Emotions Felt

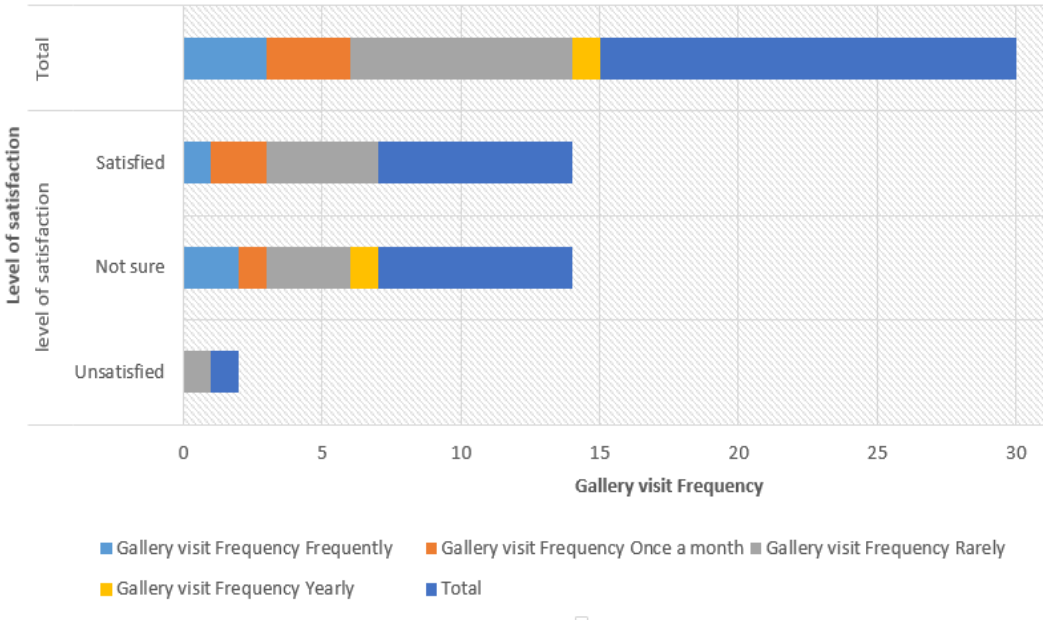

Figure 6c: Stacked Bar present Cross tabulation Gallery visit frequency v Level of Satisfaction.

The scattered bar with bubble in figure 6b show a relationship between level of satisfaction and emotion felt in Hour Glass Art gallery. 5 satisfied respondents connected their emotion to sadness. 4 satisfied respondents tied their satisfaction to happiness while 2 satisfied respondents were not sure of their emotion. In figure 6c, the stacked bar present a relationship between gallery visit frequency and level of satisfaction in Nike Art Gallery. 14 respondents amounting to 93% confirm that the level of satisfaction determine the frequency of their visit to the gallery. This also further determine the degree of patronage.

5.0 Discussion-Case Study Observations

Three other respondents were asked a question each concerning the lighting present in the respective galleries to supplement the observations made in the case study observation guides as shown in table 1. In the Hour Glass Art Gallery, the Respondent – An attendant who preferred to stay anonymous said: *"Here we use lights that don't bring heat. They protect the art works. Normal lights can hurt the art work. The intensity of the light should be subdued always. We don't use windows to protect the art from direct sunlight".*

The main focus for the gallery was to protect the art work, which almost completely excluded natural lighting as was observed during the collection of data by the authors using the observation guide. See figure 7a and b.

On the other hand, Mrs Nike responded to question saying: "*The only conscious decision to use fluorescent lights on all floors. We wante use a skylight but it was too expensive so we used windows* "as shown in figure 8a & b.

Figure 7a & b: Exhibition hall in Hour glass art gallery with artificial lighting

Table 1: Case study of Hour Glass Art Gallery, at Victoria Island, Lagos

Parameter Observed	Observation
Major Facilities	The gallery features three main exhibition rooms. One large one on the ground floor and two smaller ones on the upper floor. The staff also have a kitchenette space adjacent to the one of the art storages rooms
Dominant interior Building materials	The walls are painted in white. The floors are finished on the ground floor with brown coloured vitrified tiles and with vinyl tiles on the first floor
Use of artificial light and/ daylight	But for one window on the ground floor, the building relies solely on artificial light for the entire gallery.
Lighting elements present (Light shelves, reflective panels, shading devices etc.)	There are no light shelves, reflective panels or shading devices to note. The windows are completely covered. Admittance of light into the building is only via the artificial fixtures
Nature of Light Apertures (Size, shape and location)	The single window present is a 1.2 x1.2m sized window.

Figure 8a & b: Nike art gallery: admittance of day light via shaded windows in upper spaces

The last answer came courtesy of an artist in the Nike Art gallery who *said "the Lighting scheme was not something of much concern to us. Therefore, we left everything to the Architects".* See table

Table 2: Case study of Nike Art Gallery, at Ikate, Lekki, Lagos, constructed in 2008

Parameter Observed	Observation
Major Facilities	The art centre is comprised mainly of the main art halls and the dedicated art store building adjacent to the main building.
Dominant interior Building materials	The floor is finished with ceramic floor tiles and the sand Crete walls are painted in white all through.
Use of artificial light and/ daylight	The building's interior relies mainly on artificial lights (fluorescent lights). The natural light fixtures are used for staircases as well as the less visited parts of the gallery
Lighting elements present (Light shelves, reflective panels, shading devices etc.)	The side apertures when present are decorated with metal work motifs that act as filters for the lights. The exhibition spaces also feature mirrors that serve to reflect the lights more evenly across the space.
Nature of Light Apertures (Size, shape and location)	With the exception of a few spaces, the windows present are small slender rectangles (600 by 2100mm). They are located at the staircases and the boundary rooms used for more private exhibitions.

In the Nike Art Gallery, the design featured the blend of natural and artificial lighting and this perhaps contributes to a more sustainable outcome. The Hour glass art gallery made conscious efforts to preserve art work by excluding natural light. The decision can be viewed as less sustainable on the basis of energy consumption. However, the data gathered did not show a conclusive link between the lighting and the levels of user patronage. And there was no significant difference being observed between the galleries in question.

6.0 Conclusion and Recommendations

From the data above it can be inferred that in the two galleries the lighting strategies have not presented much disparities. The Hour glass art gallery, being mainly artificial, while the Nike art gallery relying on both daylight and artificial light in different spaces. Concerning user experience, the study showed that users were reported to be relatively satisfied and for most users the lighting in the two galleries were associated with feelings of happiness or were unsure of their feelings. However, the lighting responses supporting reports of happiness in the Nike Art Gallery were significantly higher. In general, the feedback in most galleries was that the lighting aided interest, and learning. The hypothesis "An art centre integrating more sustainable lighting strategies can be expected to demand more patronage from users as the users are intuitively attracted to the benefits of such

a design" is proven wrong in this scenario with the Hour glass art gallery reporting more patronage than the Nike Art Gallery. The Users in the Nike Art gallery were reported to be just as satisfied but are happier. The prediction might be (before further more conclusive studies) that if the study is conducted on a larger scale with sufficiently implemented lighting systems artificial or Natural lighting can be expected to attract similar amounts of patronage.

References

Aderonmu, P., Adesipo, A., Erebor, E., Adeniji, A., & Ediae, O. (2019). Assessment of Daylighting Designs in the Selected Museums of South-West Nigeria: A Focus on The Integrated Relevant Energy Efficiency Features. *MS&E*, *640*(1), 012034..

Alagbe, O. A., Aderonmu, P. A., & Dare-Abel, O. A. (2015). The Designers' Task, Dynamics and Integration of Solar Energy in Buildings. *The Designers' Task, Dynamics and Integration of Solar Energy in Buildings*, 1-16.

Baker, N., and Steemers, K., (2014). *Daylight design of buildings: a handbook for architects and engineers*. Routledge.

Cassar, M., (2013). *Environmental management: guidelines for museums and galleries*. Routledge.

Çevik, A., and Kazanasmaz, T., (2019, April). Reviewing Current Practices and Studies in Museum and Gallery Lighting. In *5th International Conference on New Trends in Architecture and Interior Design* (p. 27).

Çevik, A., Kazanasmaz, T., and Duran, H. E., (2020). User Lighting Preferences Based on Navigation and Space Quality in Virtual Exhibition Environments. Light & Engineering, 28(2).

Emrah. B., and Ashleigh B., (2013). *A case Study on Lighting for Museums and Galleries* Museums and Galleries Queensland

Emrah, B., Richard, C., Fiona, T., and Julian, B., (2013). *A Practical Guide for Sustainable Climate Control and Lighting in Museums and Galleries.* Museums and Galleries Queensland

Guimaraes, M. Y., (2019). *Natural lighting for sustainable design of art exhibition spaces: daylighting design catalogue* (Master's thesis, Universitat Politècnica de Catalunya).

Guyer, J. P. (Ed.). (2018). *An Introduction to Sustainable Building Design and Construction.* Guyer Partners.

Hassanizadeh, N., Noorzai, E., and Mohseni, A., (2020). Identification of effective criteria to improve lighting quality in existing art museums. *Journal of Facilities Management.*

Lechner, N., (2014). Heating, cooling, lighting: Sustainable design methods for architects. *John Wiley& sons.*

Markusen, A., Johnson, A., Connelly, C., Martinez, A., Singh, P., and Treuer, G., (2006). Artists' Centers: Evolution and Impact on Careers, Neighborhoods and Economics. *Creative City Network of Canada Research.*

Neirotti, P., De Marco, A.,Cagliano, A. C., Mangano, G., and Scorrano, F., (2014). Current trends in Smart City initiatives: Some stylised

facts. *Cities*, *38*, 25-36. Retrieved from: www.sustainability.williams.edu/green-building-basics/lighting

Robertson, M., (2017). Sustainability principles and practice. *Taylor & Francis.*

Shi, L., and Chew, M. Y. L., (2012). A review on sustainable design of renewable energy systems. *Renewable and Sustainable Energy Reviews*, *16*(1), 192-207.

Sylvania, F., (2015). Lighting for museums and galleries. *Havells Sylvania Copyright*, 44.

Tregenza, P., and Wilson, M., (2013). Daylighting: architecture and lighting design. *Routledge*

.